UNIVERSIDAD NACIONAL DE INGENIERIA
FACULTAD DE INGENIERIA MECANICA

"SUMINISTRO E INSTALACION DE UN SISTEMA DE AIRE ACONDICINADO POR AGUA HELADA PARA UN EDIFICIO COMERCIAL. CAPACIDAD: 310 TONELADAS"

INFORME DE INGENIERIA

PARA OPTAR EL TITULO PROFESIONAL DE

INGENIERO MECANICO

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PROMOCION 1997-I

LIMA-PERU

2002

TABLA DE CONTENIDO

PRÓLOGO

El presente Proyecto considera los trabajos por el Suministro e Instalación de un Sistema de Aire Acondicionado por Agua Helada para un Edificio comercial propiedad de Telefónica.

El Sistema tiene una capacidad total de enfriamiento de 310 Ton. de refrigeración.

Este Proyecto es particularmente interesante porque es uno de los Primeros Edificios, de esta categoría, en tener un Sistema de Control y Monitoreo Inteligente para todas sus instalaciones, incluyendo el Sistema de Aire Acondicionado. Anteriormente se hablaba de Edificios Inteligentes pero sólo se dejaban habilitadas las "previsiones" para tal fin y no se llegaban a implementar por distintas razones.

Si bien la programación del Sistema Inteligente para el sistema de climatización fue hecho fuera del país, la instalación, pruebas y puesta en marcha fue realizada por personal nacional que asimiló perfectamente la nueva tecnología y conocimiento, mostrando capacidad y conocimiento.

La implementación de este proyecto es una muestra de la capacidad del profesional y técnico nacional que tienen todas las condiciones para asumir los retos de la nueva tecnología que por distintos

motivos aún no llega o en muy pequeñas cantidades y que inversión por medio continúen llegando y desarrollándose en nuestro país.

El capítulo primero se hace una descripción general del Proyecto e información complementaria del mismo mientras que el capítulo segundo es un resumen de los conceptos teóricos básicos necesarios para comprender adecuadamente los procesos térmicos y de configuración de los Sistemas de climatización.

El capítulo tercero trata de la ingeniería del proyecto y de las consideraciones durante la instalación del sistema y el capítulo cuarto es sobre la estructura de costos del proyecto.

Es necesario indicar que las unidades utilizadas tanto en el Proyecto como en el desarrollo de este Informe son las Unidades Inglesas debido al arraigo que tienen éstas en este campo pues desde el dimensionamiento de ductos metálicos, pasando por tuberías de acero hasta capacidades térmicas y caudales de agua y aire todas las unidades son las inglesas y su uso es práctica común en catálogos, especificaciones técnicas, planos, etc.

CAPÍTULO I

INTRODUCCIÓN

Este Informe de Ingeniería trata del Suministro e Instalación de un Sistema de Aire Acondicionado y su respectivo Sistema de Control y Monitoreo para el Nuevo Edificio Grimaldo del Solar, propiedad de Telefónica el cual fue ganado por la empresa Termo Sistemas SAC en un concurso privado de costos efectuado por Telefónica para su nuevo edificio de Oficinas en el año 1998.

El Edificio materia del Proyecto está situado en la esquina de las avenidas Benavides y Grimaldo del Solar del distrito de Miraflores, tiene un área construida total de 16,916 m2 las cuales se reparten en 5 niveles de Estacionamientos Subterráneos y 12 pisos de Oficinas y Atención al Público.

El Proyecto de Arquitectura pertenece a ARCO Arquitectos Asociados SRL y el Proyecto Electromecánico a la firma Díaz-Déustua Ingenieros.

El Sistema de Aire Acondicionado es del tipo Agua Helada con Sistema de Volumen Variable tanto en el Circuito de Agua Helada de Aire basándose en el criterio de Ahorro de Energía.

Para cubrir la carga de refrigeración se considera una Planta de Frío formada por 02 unidades enfriadoras de agua (chiller) de compresor tipo Tornillo de una capacidad de 155 Ton. cada uno y 02 bombas de agua

helada primaria de 7.5HP cada una, 02 bombas de agua helada secundaria de 20HP cada una y 02 bombas de agua de condensación de 20HP cada una. Además se cuenta con dos torres de enfriamiento de 450gpm cada una.

Para distribuir el aire frío dentro del edificio se cuenta con 10 unidades manejadoras de aire de 7.5HP y una unidad de 10HP además de 15 fan coils.

El Edificio cuenta además con un Sistema de Extracción de Monóxido de Carbono en los cinco niveles de estacionamientos subterráneos para mantener la calidad de Aire requerida.

El Sistema de Aire Acondicionado tiene una Capacidad Instalada de 310 Ton. de Refrigeración (Agua Helada). El Sistema de Ventilación de Sótanos es de una Capacidad de 57,300 cfm.

La eficiencia del Chiller, bajo las condiciones de diseño del proyecto, es de 0.605 kW/Ton, un valor altamente eficiente y casi comparable a un chiller centrífugo, lo cual asegura un funcionamiento óptimo desde el punto de vista del manejo de energía y de confort.

Todos estos equipos son gobernados por un Sistema Central de Control y Monitoreo que supervisa la operación de los mismos y genera automáticamente reportes de alarmas y eventualidades a través de una interface amigable para el usuario.

CAPÍTULO II

PRINCIPIOS GENERALES DE REFRIGERACIÓN Y AIRE ACONDICIONADO

2.1.-Ciclo de Refrigeración Mecánica.- En la fig. 2-1 se muestra un sistema de refrigeración simple. Los componentes básicos del sistema son:

- Válvula de Expansión
- Evaporador
- Compresor
- Condensador y
- Tuberías de interconexión.

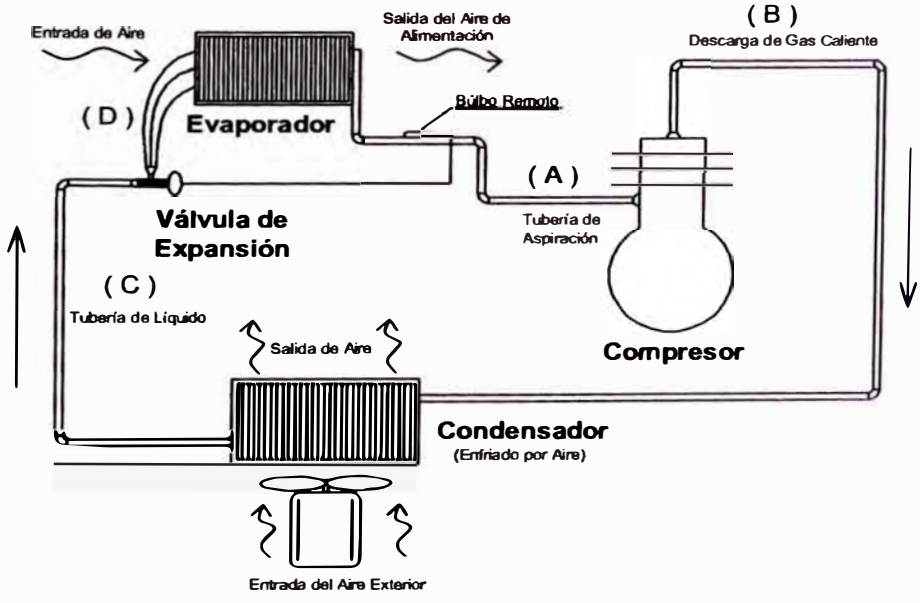

Fig. 2-1: Ciclo de Compresión Mecánica

El compresor toma el refrigerante vaporizado del evaporador a través de la línea de succión (punto A en la fig. 2-1). En el compresor, la presión del refrigerante aumenta desde la temperatura y presión de vaporización hasta una presión y temperaturas de descarga mucho más altas. En la línea de descarga (B), el refrigerante está todavía en estado de vapor a alta temperatura, normalmente de entre 100 y 860°F. Se puede utilizar un medio de refrigeración (agua o aire) relativamente templado para condensar y sub-enfriar el vapor caliente. En el condensador, el calor de vaporización y compresión es transferido del gas refrigerante al medio de enfriamiento a través de las paredes de las superficies de transferencia de calor del condensador a medida que el gas se licua a una presión igual o inferior a la presión de descarga del compresor.

La válvula de expansión separa el lado de alta presión, del sistema de baja presión. El propósito de la válvula de expansión es controlar la cantidad de líquido que entra en el evaporador de tal forma que exista una cantidad suficiente para evaporar pero sin inundar el evaporador (D).

En el evaporador, el refrigerante líquido se vaporiza completamente mediante el calor tomado de la Carga del edificio. El calor equivalente al calor latente de vaporización es transmitido de la carga al refrigerante de baja temperatura a través de las paredes del evaporador. De esta forma la carga es enfriada y deshumidificada. El punto de ebullición (temperatura de vaporización) a la presión del evaporador es normalmente entre 35 y 45°F para los refrigerantes R-11, 12 y 22.

Del evaporador, el refrigerante es conducido a través de la tubería de aspiración al compresor, repitiéndose el ciclo.

La cantidad de calor necesaria para evaporar 1kg. de refrigerante líquido varía de acuerdo a las características de los refrigerantes. El punto de ebullición de un refrigerante ideal debe ser inferior a la temperatura de suministro del aire/agua y superior a 32°F, para que no se congele el agua condensada del aire de suministro del sistema o el agua que circula por el mismo en un sistema de agua helada. La mayoría de los refrigerantes utilizados en la actualidad tienen un punto de ebullición relativamente bajo y propiedades no irritantes, no tóxicas, no explosivas, no inflamables y no corrosivas para uso con los materiales de las tuberías comercialmente disponibles.

La siguiente figura muestra el ciclo teórico de refrigeración en un diagrama P-h o llamado de Moliere. La característica de este ciclo es que no presenta pérdidas de presión en el sistema y sin el sub-enfriamiento del líquido o recalentamiento del vapor.

2.2.-Psicrometría

2.2.1.-Leyes Psicrométricas

- Cuando el aire seco se satura adiabáticamente, la temperatura se reduce y la humedad relativa se incrementa y la reducción de calor sensible es igual al incremento simultaneo de calor latente.

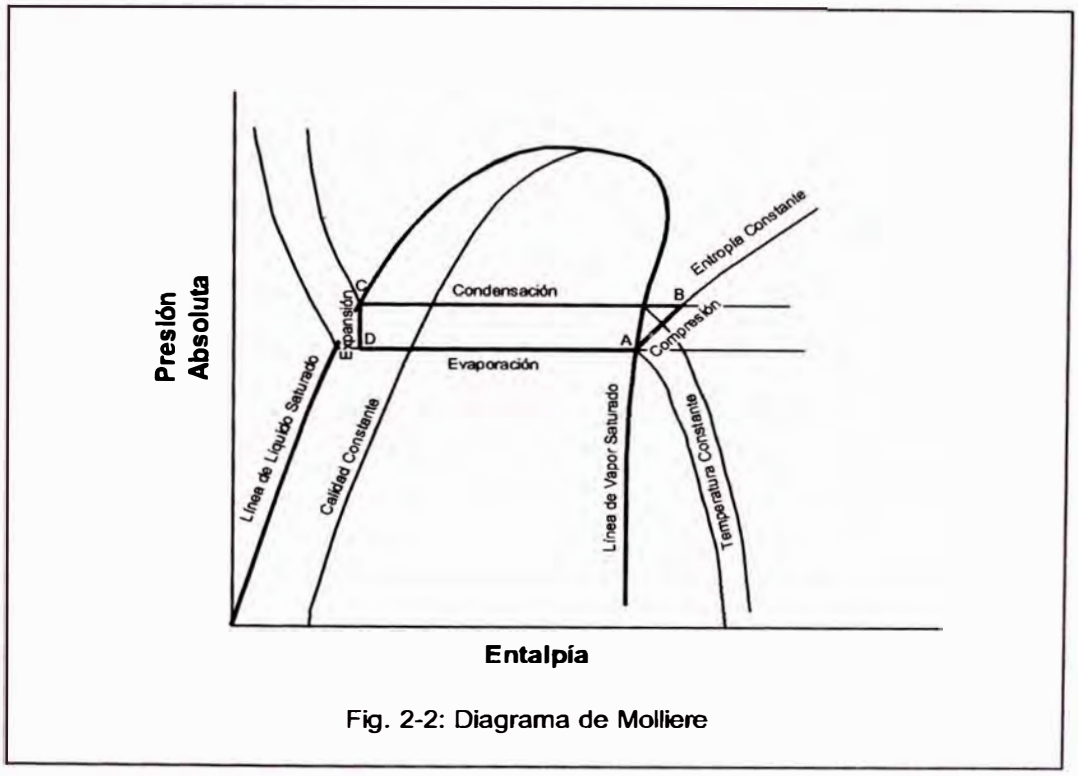

Fig. 2-2: Diagrama de Molliere

- Cuando el contenido de humedad del aire se incrementa adiabáticamete hasta que la presión de vapor corresponde a la temperatura de saturación, ésta se llama "Temperatura de Saturación Adiabática".
- Cuando cierta cantidad de agua aislada se evapora, se supone que la temperatura final será la adiabática de saturación y no está afectada por convección, por lo que la temperatura de bulbo húmedo será la adiabática de saturación.
- La temperatura de bulbo húmedo del aire depende sólo del calor total sensible y latente y es independiente de sus proporciones relativas. En otras palabras la temperatura de bulbo húmedo es constante ya que el calor total también lo es.

2.2.2. Carta Psicrométrica .- La carta psicrométrica es la representación gráfica de las tablas y con ella se pueden analizar gráficamente las propiedades psicrométricas. La carta muestra, básicamente, la relación entre las cinco siguientes propiedades del aire:

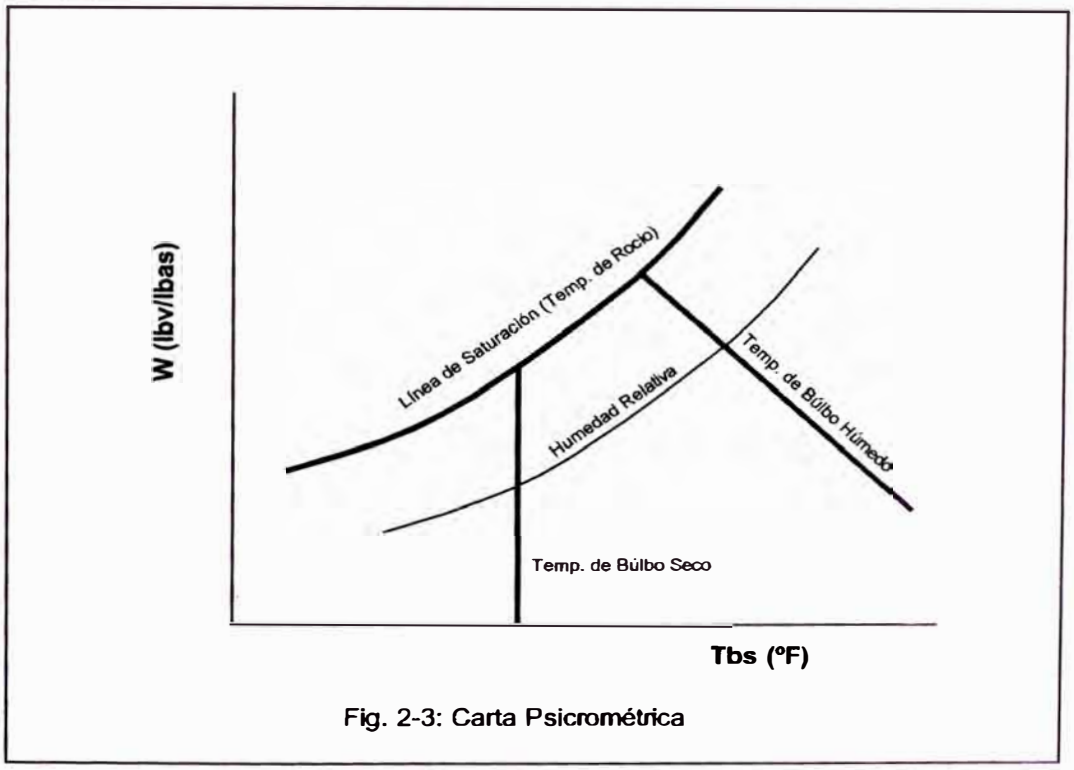

Fig. 2-3: Carta Psicrométrica

- Temperatura de Bulbo Húmedo (TBH)
- Temperatura de Bulbo Seco (TBS)
- Temperatura de Rocío
- Humedad Relativa
- Humedad Específica

2.2.3.- Procesos Psicrométricos .-

2.2.3.1.-Mezcla de Dos Flujos de Aire .- Se tienen dos masas de aire M1 y M2 que al mezclarse, se comportan de acuerdo a las siguientes expresiones:

$$M1 + M2 = M3 \qquad (a)$$

$$M1 \times W1 + M2 \times W2 = M3 \times W3 \qquad (b)$$

$$M1 \times h1 + M2 \times h2 = M3 \times h3 \qquad (c)$$

Donde:

M : Masa de aire en Lb/hr.

h : Entalpía Total en Btu/Lba

W : Humedad Específica en Lbv/Lba

Este proceso se lleva a cabo sin aumentar o disminuir calor o humedad.

Combinando las ecuaciones anteriores (a), (b) y (c) tenemos:

$$M1 / M2 = (W3 - W2) / (W1 - W3) = (h3 - h2) / (h1 - h3)$$

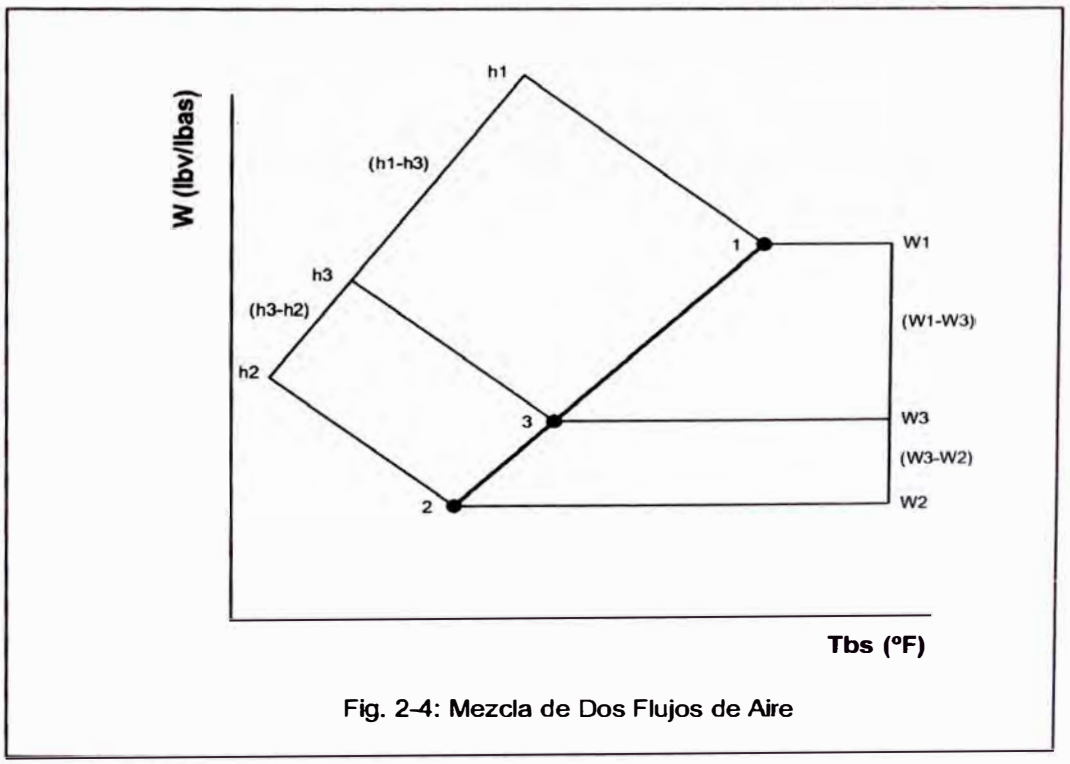

Fig. 2-4: Mezcla de Dos Flujos de Aire

2.2.3.2.-Enfriamiento Sensible .- En este proceso el aire sufre un enfriamiento con humedad específica constante y al mantenerse este valor constante entonces no se produce condensación.

El calor removido se puede expresar:

$$Qs = M \times (ha - hb) \qquad Btu/hr$$

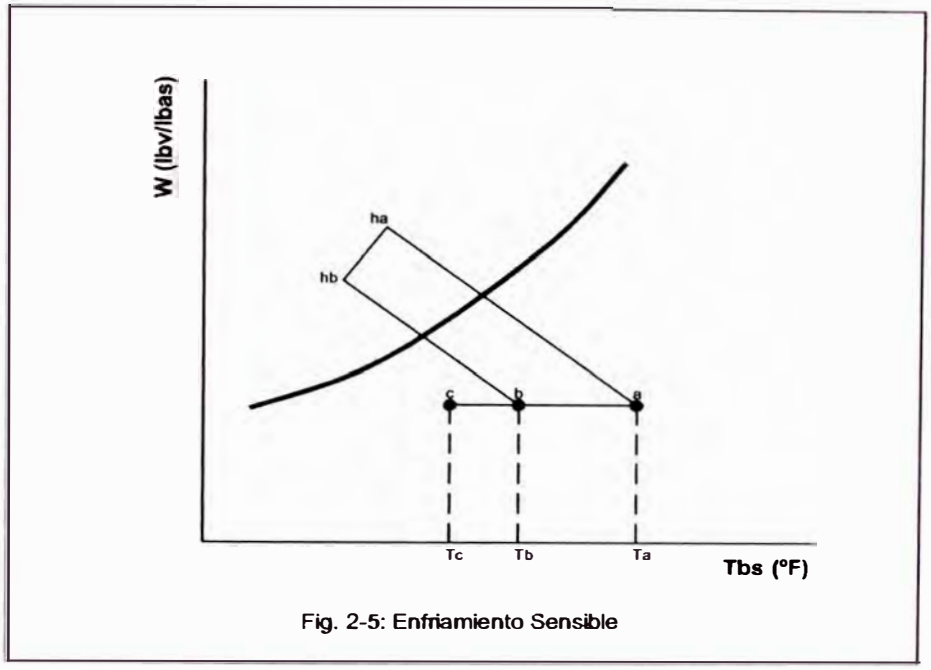

Fig. 2-5: Enfriamiento Sensible

2.2.3.3.-Enfriamiento con Deshumidificación .- En este proceso el aire pasa a través de una superficie que se encuentra por debajo de la temperatura de punto de rocío del aire, entonces se condensará parte de la humedad del aire y la mezcla se enfriará simultáneamente.

Parte del aire que está en contacto directo con la superficie reduce su temperatura hasta la temperatura media de la superficie, según el trazo "a c d ", con condensación y consecuente deshumidificación de "c" a "d".

El aire que no está en contacto con la superficie, finalmente se enfriará al mezclarse con el aire que sí tuvo contacto, y su estado final caerá sobre la línea recta entre "a" y "d". El trayecto real no es la línea recta "a d", sino una curva parecida a la punteada. Esto se debe a la continua mezcla del aire que estuvo en contacto directo con el aire que nunca lo estuvo.

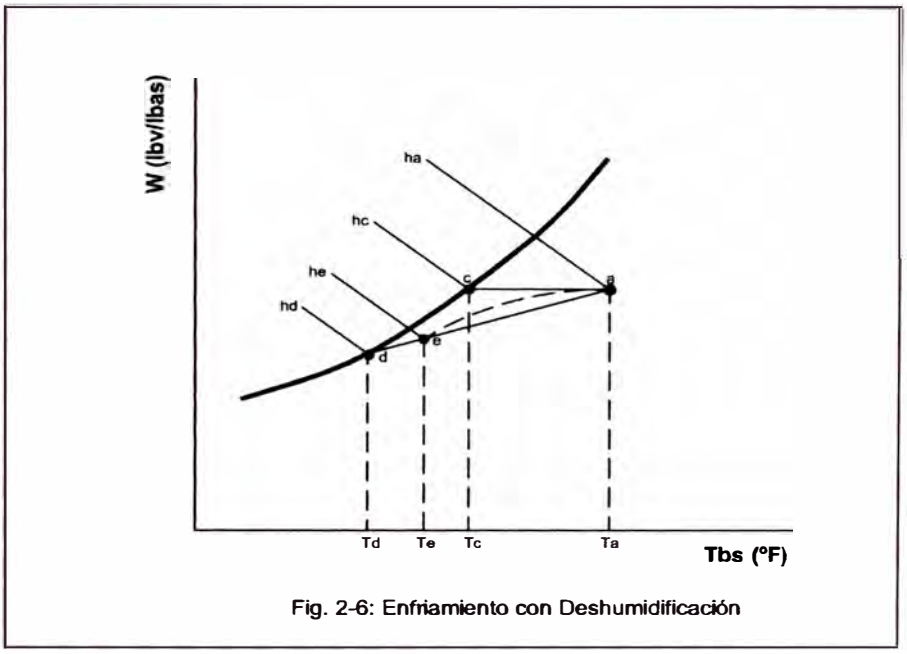

Fig. 2-6: Enfriamiento con Deshumidificación

En los procesos que incluyen condensación, la temperatura Td se llama Punto de Rocío del Aparato.

El Calor Latente removido durante el proceso es:

$Ql = M \times (Wa - We) \times 1060 / 7000$ Btu/hr

Donde 1060 es el calor latente de vaporización en Btu/Lb

El calor Sensible retirado es:

$Qs = 1.08 \times C \times (Ta - Td)$ Btu/hr

Donde:

C: Caudal de aire en cfm

T: Temperatura del aire en °F

El Calor Total es :

$Qt = Qs + Ql$

$Qt = 4.45 \times C \times (ha - hd)$ Btu/hr

La relación del calor sensible retirado al calor total retirado se le llama Factor de Calor Sensible:

$$R = Qs / Qt$$

2.2.3.4.-Enfriamiento y Humidificación .- Siempre que el aire no saturado pasa a través de un aspersor de agua, la humedad específica aumenta y la temperatura de bulbo seco baja. Esto constituye el proceso de saturación adiabática es decir, es un proceso a temperatura de bulbo húmedo constante.

El bulbo húmedo del aire está representado por el punto"c". El aire saldrá a esta temperatura siempre que exista un buen contacto entre "aire-agua".

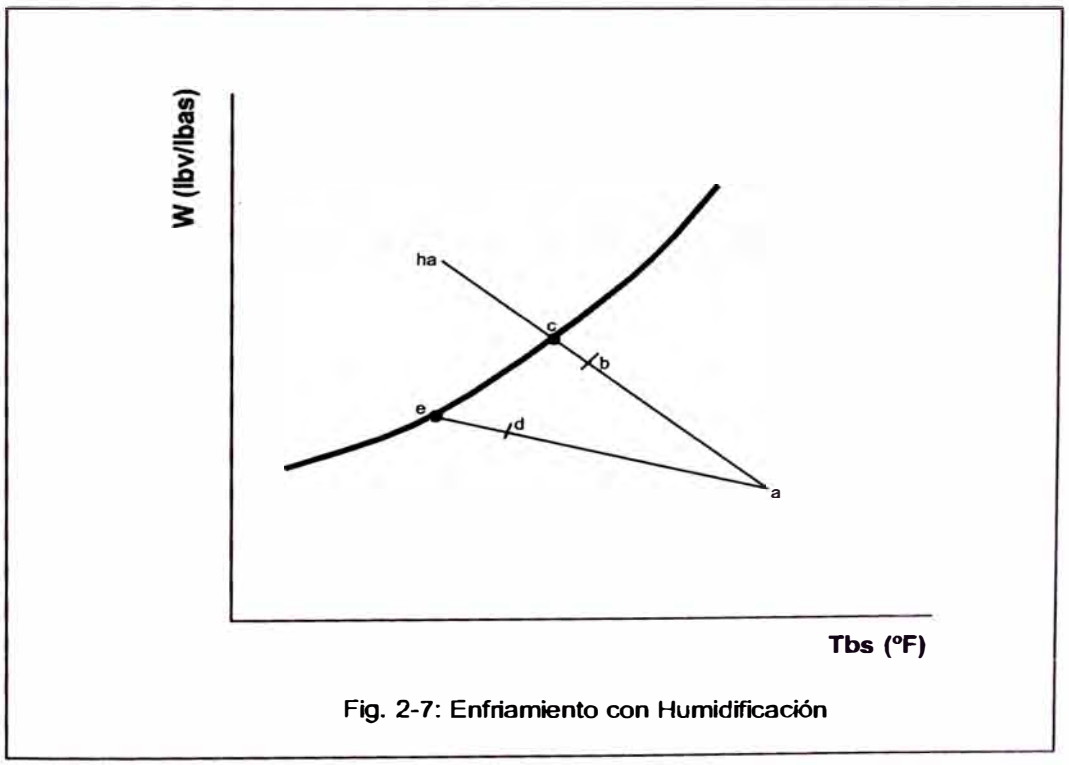

Fig. 2-7: Enfriamiento con Humidificación

Puede suceder también que el agua esté a una temperatura menor que la del bulbo húmedo o mayor que el punto de rocío, en cuyo caso, el proceso lo muestra la línea "a d", y se enfría y humidifica simultáneamente.

El aspersor de agua tendrá que ser de recirculación continua para que se establezca el equilibrio.

2.2.3.5.-Calentamiento y Humidificación .- Cuando el aire pasa a través de un humidificador, el aire se humidifica y puede calentarse, enfriarse o permanecer a la misma temperatura. Durante este proceso, el aire incrementa su humedad específica y entalpía, y la temperatura inicial del aire y del agua. Si se suministra suficiente agua en relación con el aire, éste se acercará a la saturación.

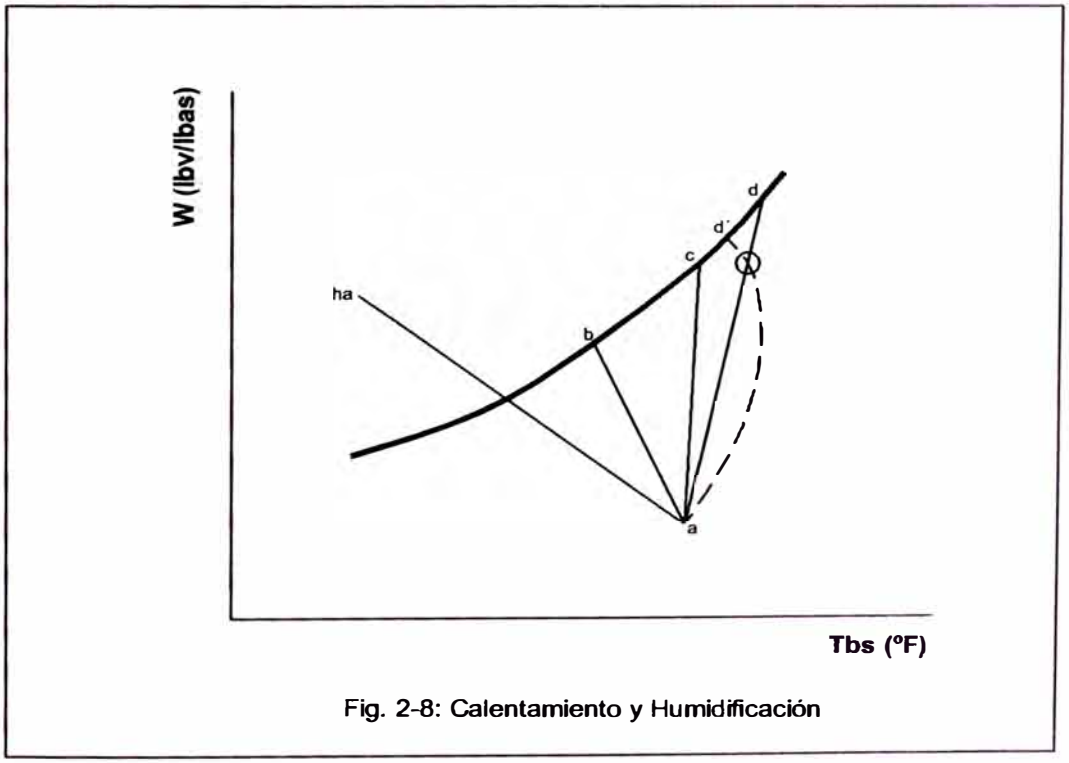

Fig. 2-8: Calentamiento y Humidificación

Según la figura:

a – b : La temperatura del agua es menor que la del aire.

a – c : El agua está a la misma temperatura que el aire.

a – d : El agua está a mayor temperatura que el aire.

Cuando el agua es relativamente poca, la línea "a - d" cae según indican los puntos "a – d' ".

2.3.-Sistemas de Aire Acondicionado

Podemos dividirlos de acuerdo a la forma en que se obtiene la climatización del ambiente acondicionado y las más utilizadas son las siguientes:

- Expansión Directa (DX).
- Sistemas Todo Agua
- Sistemas Todo Aire y

2.3.1.-Sistema de Expansión Directa (DX) .- El Sistema de Expansión Directa aprovecha la temperatura, la presión y el calor latente de vaporización del fluido refrigerante que evolucionan en el ciclo para enfriar el aire que será insuflado a las áreas a climatizar. Para vaporizar el refrigerante líquido, el calor latente de vaporización debe ser aplicado al líquido y es tomado del aire que pasa a través del serpentín evaporador (ver fig. 2-1).

Los sistemas de climatización por expansión directa están disponibles como equipos de tipo ventana con capacidades de refrigeración de menos de 24,000 Btu/hr hasta grandes equipos compactos de más de 100 Ton. de refrigeración. Pueden ser de construcción tipo Paquete en la que todos los componentes, incluyendo los controles están contenidos en el mismo equipo, o de un sistema Split en el que el condensador y el compresor están contenidos en un gabinete (Unidad de Condensación) en el exterior del ambiente climatizado y el Serpentín de Enfriamiento y Válvula, no necesariamente, dentro del edificio en la llamada Unidad Evaporadora. En

este caso, las tuberías de refrigerante (líneas de líquido y de gas) deben ser instaladas y aisladas (sólo la de gas) en obra.

2.3.2.-Sistema Todo Agua .- Este sistema consiste en utilizar como medio refrigerante agua helada o salmuera que circula por el serpentín de enfriamiento de los equipos terminales ya sean Fan Coils o Unidades Manejadoras de Aire.

El agua helada es generada en forma remota en el evaporador de un enfriador (Chiller). El enfriador, que es una máquina de refrigeración integrada, transfiere internamente el calor desde el evaporador al condensador, donde el calor es descargado a la atmósfera por el sistema de condensación.

El agua helada que sale del evaporador es conducida hasta a los serpentines de enfriamiento de equipos terminales (fan coils, unidades manejadoras de aire, etc) que recogen el calor y humedad de los ambientes acondicionados y lo transfieren por convección y radiación al agua helada que circula por ellos y que es nuevamente conducida al enfriador para continuar el ciclo.

La fig. 2-9 muestra un Sistema de Agua Helada donde se puede apreciar sus diferentes componentes. Es usado mayormente en sistemas de grandes capacidades.

El principio de operación se refleja en la siguiente figura:

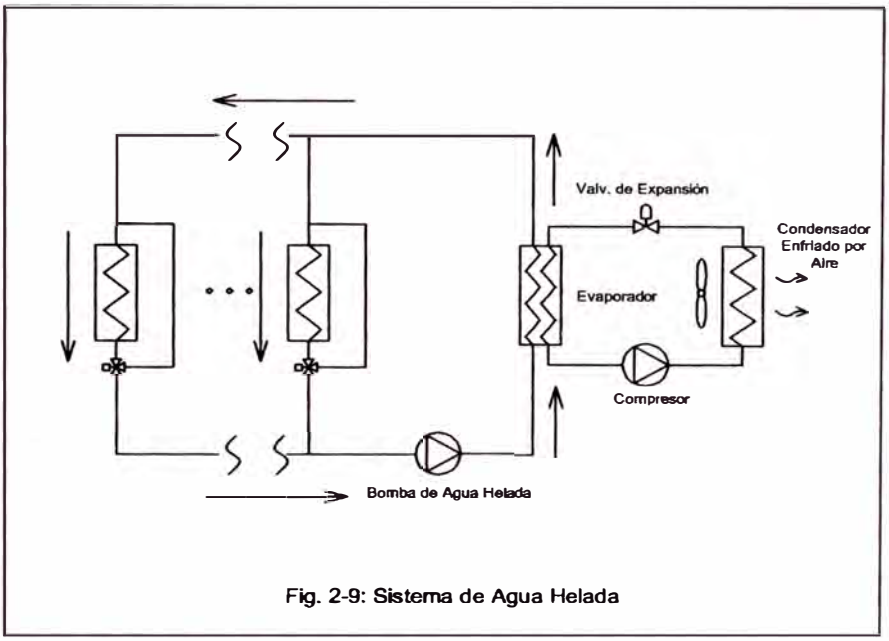

Fig. 2-9: Sistema de Agua Helada

2.3.3.-Sistema Todo Aire.- Cuando se tienen sistemas de este tipo, entonces se utiliza un equipo central de distribución de Aire frío (Unidad Manejadora de Aire por ejemplo) que por lo general está distante del área acondicionada y el aire es conducido a través de una red de ductos metálicos hasta las zonas a climatizar.

La siguiente figura grafica este sistema.

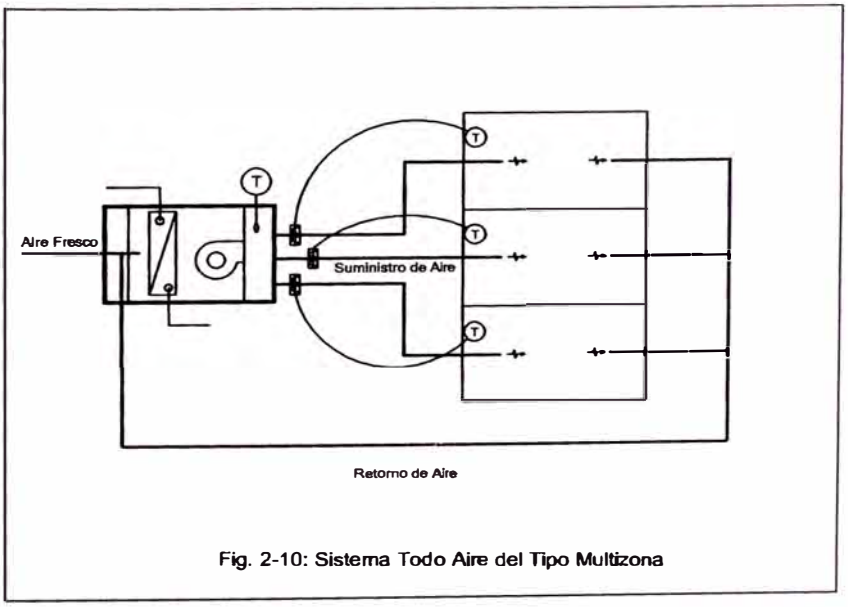

Fig. 2-10: Sistema Todo Aire del Tipo Multizona

CAPÍTULO III

INGENIERÍA DEL PROYECTO Y LA INSTALACIÓN

3.1.- Características del Proyecto .-

3.1.1.-Principio de Operación del Sistema .-

El Proyecto Original, tal como fue concebido por los Proyectistas, se explica en las siguientes líneas:

"El Sistema del Aire Acondicionado previsto es del tipo Agua-Agua, considerando dos Unidades Centrales de Agua helada (Chillers) de 155 Toneladas cada uno, refrigerados por agua cuyas ubicaciones son en el cuarto sótano del edificio.

Los Chillers se han previsto instalados en paralelo de manera que funcionen ambos o uno de ellos para cualquiera de los pisos, según la demanda lo requiera.

Los chillers serán refrigerados por agua para lo cual se instalarán sobre el Techo del edificio dos torres de enfriamiento de 155 Ton. de capacidad, con una montante de agua de condensación y retorno instalado en un ducto de mampostería.

La circulación de agua helada se realizará a través de electrobombas de agua helada de tipo volumen variable y presión constante para la red secundaria, uno por cada unidad chiller y de la capacidad total de

refrigeración. Se ha previsto además el espacio para una tercera bomba que estaría en stand by.

Se ha previsto además la instalación de electrobombas de volumen constante para recirculación a través del chiller (red primaria).

El sistema de tuberías a instalar es de retorno directo con válvula de dos vías, todas las tuberías estarán debidamente aisladas y equipadas con válvulas de control para regulación de caudal mediante microprocesador.

El general en el edificio se instalarán unidades evaporadoras del tipo simple zona para la instalación vertical en salas ubicadas en cada piso, salvo el primer piso que tendrá unidades fan coil colgadas sobre el falso cielo.

Desde las unidades manejadoras o fan coils saldrán los ductos de suministro de aire en planchas galvanizadas y aisladas con planchas de fibra de vidrio de 1" de espesor aislándose los primeros 6m con aislamiento interior para eliminación de ruido en los ductos.

Se ha previsto la distribución de los ductos en forma sectorizada de manera de instalar dampers motorizados que regularán mediante termostatos de forma de mantener hasta 4 zonas con temperaturas independientes.

El retorno del aire se ejecutará considerando el falso cielo como plenum de retorno para lo cual se ha instalado ducto de plancha galvanizada de manera de conectar el plenum con la sala de máquinas.

En lo que respecta a la renovación del aire del primer piso se ha previsto instalar cerca de cada sala un inyector de aire tipo centrífugo y un ducto galvanizado que permite inyectar aire del exterior a través de rejillas

sobre el falso cielo, para los demás pisos las salas de aire acondicionado tiene una rejilla con damper para toma de aire del exterior.

Con el control de la temperatura se instalarán sensores de temperatura (termostatos) que regularán los motores damper de cada zona tal como se observa en los planos.

El Ahorro de Energía se efectuará mediante dos formas:

- Electrobombas de Volumen Variable y Presión Constante
- Sistema Inteligente.

El control se efectuará a través de Válvulas de dos vías, la cual se abre o cierran según la carga aumente o disminuya. Además se instalará un sensor de diferencia de presión entre la entrada y la salida de cada unidad manejadora o fan coil mediante la cual se reducirá la velocidad de la bomba secundaria según se requiera mayor o menor caudal de agua helada, pudiéndose de esta manera ahorrar energía, por lo tanto las bombas secundarias serán de tipo variable, mientras que existirán otras bombas primarias que serán de volumen constante y que serán utilizados para vencer la caída de presión en los chillers.

Se preveerá además un sistema de control, inteligente para control de unidades centrales, electrobombas de agua helada, unidades manejadoras y torre de enfriamiento.

La secuencia de operación será:

Unidades Manejadoras (UM) El programa de arranque y parada automática pondrá en marcha cada UM basado en un programa previamente establecido.

Cuando cualquiera de las UM es arrancada el sistema pondrá en marcha la Planta de Agua Helada, activando primera la bomba de agua helada y después que el sistema recibe la confirmación de que existe caudal de agua, el panel de control del enfriador es activado, un sensor de presión en el ducto de suministro indicará la existencia de caudal de aire, en el caso de que la unidad no arranque se genera un a alarma a través de un panel localizado en el área de mantenimiento.

Un control, de entalpía de dos posiciones está localizada en la toma exterior, enviando una señal al sistema de control, el cual dicha señal con las condiciones internas del edificio, en caso que las condiciones externas e internas lo justifiquen, la compuerta de aire de retorno se cerrarán y la de aire exterior se abrirá para permitir que siempre 100% de aire exterior entre en el edificio.

La Planta de Agua Helada, Las Bombas de agua helada se alternarán automáticamente y en caso de que fallen alguna arrancará la otra. En caso de que falle alguno de los enfriadores será indicada una alarma general en el panel central.

El Sistema de Ventilación de Sótanos será por medio de extractores centrífugos a ser ubicados en el 5to Sótano en un ambiente destinado para la ubicación de estos equipos, La toma de aire se ejecutara por medio de rejillas en pisos y ductos enterrados de mampostería conectados en sala de equipos de extracción. La descarga del aire se hará a través de ductos de plancha galvanizada hacia el exterior."

3.1.2.- Especificaciones Técnicas del Proyecto (Equipos y Materiales)

Ver Anexo A

3.2.- Propuesta Técnica .-

Aquí se presentan los Principales Equipos, Materiales y Sistemas Suministrados e Instalados en la Obra.

3.2.1.- Equipamiento Principal.-

Se indicará los principales equipos que fueron suministrados e instalados y sus principales Características Técnicas.

3.2.1.1.-Unidad Enfriadora de Agua (CHILLER)

El Equipo enfriador de líquido es una unidad integral completamente ensamblado y probado en fábrica, cuenta con dos compresores de tornillo, cargas de aceite refrigerante, y microprocesador para control del equipo.

El Compresor es de un tornillo con un rotor de tornillo principal que se une con 2 rotores diametralmente opuestos. Los dos rotores que están exactamente opuestos producen 2 ciclos de compresión opuestos que resultan en fuerzas balanceadas sobre el compresor.

El tornillo principal cuenta con 6 ranuras helicoidales y esta construido de una fuerte aleación de acero. Los rotores laterales cuentan con 11 dientes que se encuentran localizadas en los extremos opuestos del tornillo. "Los rotores están construidos de un compuesto impregnado de carbón. Los soportes de los rotores son de hierro fundido".

El compresor es semi-hermético, el motor eléctrico esta sellado herméticamente y es de tipo de inducción de jaula de ardilla enfriado por refrigerante liquido.

Un sistema de inyección de refrigerante se utiliza para sellar fugas entre el lado de alta y baja presión.

El compresor cuenta con dos válvulas deslizantes para el control de la carga.

El Evaporador es del tipo de expansión directa con barril de acero de carbón, y con placas para distribución del agua de polipropileno para resistir a la corrosión. Los tubos son sin costura y aleteados internamente de cobre. Los cabezales del lado del refrigerante son de acero de carbón y son removibles para permitir acceso a los tubos de cualquier lado. Cuenta con puntos d ventilación o purga para sacar el agua fácilmente.

El Panel de Control cuenta con los elementos de arranque instalados de fábrica: Fusibles en el circuito de control, contactores, secuenciador y timers de arranque, protección de sobrecarga trifásica para el compresor y un block de terminales para conexión en el campo a un switch de desconección remoto. También cuenta con terminales para el sistema de control a 115 voltios.

El equipo cuenta con un sistema de control de tipo "MICROTECH" basado en la temperatura del agua saliendo del evaporador.

El sistema de microprocesador incluye válvulas de expansión electrónica y utiliza una lógica de control para proveer un control del sobrecalentamiento optimizado de los circuitos de refrigerante.

El microprocesador calcula continuamente la presión óptima del evaporador y condensador para cada circuito basado en la capacidad en cada compresor.

El control cuenta con un teclado de 12 teclas y una pantalla de cuarzo de 32 caracteres que da acceso a temperaturas, presiones, set points, estados de operación, horarios y alarmas.

El microprocesador muestra lo siguiente:

- Temperatura de agua entrando y saliendo del evaporador
- Temperatura de agua entrando y saliendo del condensador
- Presión y temperatura de refrigerante en el evaporador para cada circuito.
- Presión y temperatura de refrigerante en el condensador para cada circuito.
- Temperaturas en la línea de succión y sobrecalentamiento para cada circuito.
- Temperaturas en la línea de succión y subenfriamiento para cada circuito.
- Posición de la válvula de expansión
- Programación de set points y estados de operación
- Mensajes de alarmas

El microprocesador incluye los siguientes accesorios:

- Switch para apagar unidad en caso de emergencia
- Algoritmo de control avanzado para la presión del condensador
- Control de bomba del evaporador a través de salidas digitales instalados de fábrica.
- Salida para alarmas remotas

- Presión de 0.1ºF para set points
- Pre-alarmas para acciones correctivas sin apagar equipo
- Historia de las 5 últimas alarmas
- Modo para control manual
- Modo de prueba para servicio
- Función para carga suave
- Dual set points para la temperatura de agua
- Control de límite de demanda
- Lead-Lag manual o automático del control de los circuitos de refrigerante
- Horas de operación y número de arranques para cada compresor
- Programación de horario por año (Semanas, días festivos) etc.
- La memoria del panel de control no necesita baterías
- Capacidad para conectarse a un sistema de control remoto
- Protocolo abierto

El sistema cuenta con las siguientes protecciones:

- Pérdida de fase, inversión de fases, sobre y bajo voltaje
- Protección a cada motor de cada compresor
- Protección al compresor de cada circuito por alta presión de descarga
- Protección contra congelamiento para cada compresor
- Baja presión
- Pérdida de flujo (Evaporador y Condensador)

- Pérdida de refrigerante
- Falta de voltaje
- Falla de las válvulas de expansión

Dos Circuitos de Refrigeración Independientes con un compresor por circuito, válvula de expansión electrónica, válvulas de servicio, válvula manual para la línea de líquido con puerto de carga, filtro deshidratador desechable, mirilla con indicador de humedad, válvula solenoide, válvulas de purga, 450 Psig. (3,104 KPA) válvulas de alivio, línea de succión aislada. Carga de gas refrigerante R134a.

Características eléctricas: 220V-60HZ-3PH

Marca:	McQuay
Modelo:	PFS-210C
Ton:	155
kw/ton:	0.605
Evaporador	
Caudal :	360 GPM
Entrada/Salida	54 / 44ºF
Condensador	
Caudal :	450 GPM
Entrada / Salida:	85ºF/95ºF
IPLV (Input Part Load Value)	0.556
Cantidad:	2

3.2.1.2.- Torres de Enfriamiento. –

Es del tipo inducido y flujo cruzado, descarga de aire vertical y

Carcasa construida totalmente de fibra de vidrio reforzado, bandeja colectora de agua construida de fibra de vidrio reforzado, soportes y componentes metálicos de acero inoxidable.

Marca:	PROTEC
Modelo:	PCT-175 (S/S)
Caudal:	450 GPM
Temperatura de entrada:	95ºF
Temperatura de salida:	85ºF
Temperatura de bulbo húmedo:	76ºF
Peso operando (Kg.):	2,171
Cantidad	2 unidades

3.2.1.3.- ElectroBombas de Agua y Accesorios.-

BOMBAS DE AGUA HELADA PRIMARIAS:

Marca :	TACO
Modelo :	FE-3008
Capacidad:	360 GPM
Altura:	42 FtH2O
Revoluciones:	1760 RPM
Características eléctricas:	220/3/60Hz-7.5 HP
Cantidad:	2 Unidades

BOMBAS DE AGUA HELADA SECUNDARIAS :

Marca:	TACO
Serie:	FE-2513
Capacidad:	360 GPM

Altura:	114 FtH2O
Revoluciones:	1760 RPM
Características Eléctricas:	220/3/60Hz-20 HP
Cantidad:	2 Unidades

BOMBAS DE CONDENSACIÓN:

Marca:	TACO
Serie:	FE-3013
Capacidad:	450 GPM
Altura:	114 pies
Revoluciones:	1760 RPM
Características eléctricas:	220/3/60Hz-20HP
Cantidad:	2 Unidades

Válvulas Multipropósito para la Descarga de las Bombas de Agua

Marca:	TACO
Modelo:	MPV-025 Y MPV-030
Diámetro:	2 ½" y 3"
Cantidad:	2 y 4 respectivamente

3.2.1.4.-UNIDADES TIPO FAN COIL

Marca MCQUAY Para ser instaladas dentro de falso cielo raso, del tipo HIDEAWAY, modelos TSH y SHB. Todas las unidades cuentan con ventiladores centrífugos silenciosos de doble ancho y doble entrada con hojas inclinadas hacia adelante (FORWARD CURVE BLADES) de bajo nivel de ruido fabricados en material no corrosivo, accionado por motor eléctrico transmisión directa o por fajas y poleas. Caja de mezcla y filtro para retorno.

Los serpentines son de tubo de cobre y aletas de aluminio con bandeja receptora de condensado y bandeja secundaria. Cada unidad fan coil de aire contará con válvulas de 2 vías On/Off.

El control de las unidades serán mediante un termostato que actúa sobre la válvula de dos vías para controlar la temperatura en los ambientes, comandados por el programa del Sistema de Control Inteligente.

Para el detalle de capacidades de cada Fan-Coil, ver hojas de selección.

- FC-1-1

Modelo:	SHB-301B
	Optional 6 Row coil - 1 HP
Capacidad total:	87,541 BTU/HR
Capacidad sensible:	61,589 BTU/HR
Caudal de aire:	2,670 CFM
Caudal de agua:	17.5 GPM
Cantidad:	01 Unidad

- FC-1-2 / FC-1-3

Modelo:	SHB-201B
	Optional 6 Row coil - 0.75 HP
Capacidad total:	55,887 BTU/HR
Capacidad sensible:	40,434 BTU/HR
Caudal de aire:	1,650 CFM
Caudal de agua:	11.2 GPM
Cantidad:	02 Unidades

- FC-1-4

Modelo:	SHB-301B
	Optional 6 Row coil - 0.75 HP
Capacidad total:	82,047 BTU/HR
Capacidad sensible:	56,877 BTU/HR
Caudal de aire:	2,400 CFM
Caudal de agua:	16.4 GPM
Cantidad:	01 Unidad

- FC2-1

Modelo:	TSH-101F
	High capacity coil / high static
motor	
Capacidad total:	23,911 BTU/HR
Capacidad sensible:	17,741 BTU/HR
Caudal de aire:	915 CFM
Caudal de agua:	4.8 GPM
Cantidad:	01 unidad

- FC-T

Modelo:	TSH-121F
	Standard coil / High static
motor	
Capacidad total:	27,358 BTU/HR
Capacidad sensible:	20,107 BTU/HR
Caudal de aire:	966 CFM

Caudal de agua: 5.5 GPM

Cantidad: 09 Unidades

- FC-I

Modelo: SHB-121B

Optional 6 Row coil

Capacidad total: 39,984 BTU/HR

Capacidad sensible: 29,089 BTU/HR

Caudal de aire: 1,200 CFM

Caudal de agua: 8 GPM

Motor: 0.5 HP

Cantidad: 01 Unidad

- VALVULAS DE DOS VIAS ON-OFF

Marca: Siebe

Modelos: VA22-A11CO - ½"

VA22-B11CO - ¾"

VA22-C11EO - 1"

Cantidades: 11, 2 y 2 respectivamente

3.2.1.5.-UNIDADES MANEJADORAS DE AIRE.-

Unidades totalmente ensambladas en fábrica los gabinetes están construidos en planchas de fierro galvanizado pesado (heavy gage), contando con tapas removibles que permitan el mantenimiento y reparación de las partes componentes.

En la sección enfriadora, el gabinete está aislado en la totalidad de su superficie interior con lana de vidrio de 1" de espesor con una densidad de

1.5 lb/pie3. y una conductividad térmica de 0.26 btu/hr. -pie2 (ºF.pulg.) a una temperatura media de 75ºf. así mismo el aislamiento en su superficie exterior lleva una capa de neoprene que evita la erosión del aislamiento por acción del aire. cuenta con una bandeja de drenaje, la cual recepciona y elimina el agua condensada por el serpentín enfriador, esta bandeja es de plancha de fierro galvanizado aislado térmicamente con material resistente a la corrosión.

El serpentín de expansión directa está fabricado con tubos de cobre y aletas de aluminio, asegurados mecánicamente. el ventilador es centrífugo con aletas curvadas hacia adelante (sirocco) con ventilador opcional a no mayor de 1,723 fpm de salida, bajo nivel de ruido, accionado mediante un motor eléctrico, transmisión mediante fajas y poleas de paso variable.

Los motores eléctricos llevarán variador de velocidad para el sistema de volumen variable.

El control será por medio de válvulas de 2 vías, con actuador eléctrico y termostato comandados por el sistema de control inteligente.

UM-2

Modelo:	LSL-117
	Optional FC
Capacidad total:	302,289 BTU/HR
Capacidad sensible:	219,052 BTU/HR
Caudal de aire:	8,670 CFM
Caudal de agua:	60.5 GPM
Motor:	7 ½ HP

Cantidad: 1 unidad

- UM-T

Modelo: LSL-117

Optional FC

Capacidad total: 346,334 BTU/HR

Capacidad sensible: 236,382 BTU/HR

Caudal de aire: 8,460 CFM

Caudal de agua: 69.3 GPM

Motor: 7 ½ HP

Cantidad: 9 unidades

- UM-CI

Modelo: LSL-122

Optional FC

Capacidad total: 418,916 BTU/HR

Capacidad sensible: 293,243 BTU/HR

Caudal de aire: 10,990 CFM

Caudal de agua: 83.8 GPM

Motor: 10 HP

Cantidad: 1 unidad

- VALVULAS DE DOS VIAS ON-OFF

Marca: Siebe

Modelos: VM-7213-401-4-10-1 ½"

VM-7213-401-4-11-2"

Cantidades: 1 y 10 respectivamente

3.2.1.6.- EXTRACTORES AXIALES Y CENTRIFUGOS

- EA-01

Marca:	PENN
Modelo:	P10RA
Motor:	0.08HP
Caudal de aire:	255 CFM x 0.32" c.a.
Cantidad:	1 Unidad

- IC-01

Marca:	PENN
Modelo:	ZC10
Motor:	1/4 HP
Caudal de aire:	1,210 CFM x 0.4" c.a.
Cantidad:	01 Unidad

- EC-01

Marca:	PENN
Modelo:	ZC10
Motor:	1/4 HP
Caudal de aire:	350 CFM x 0.3" c.a.
Cantidad:	1 Unidad

- EC-02

Marca:	PENN
Modelo:	ZC10
Motor:	1/4 HP
Caudal de aire:	1,000 CFM x 0.35" c.a.

Cantidad: 1 Unidad

- EC-S

Marca: PENN

Modelo: DYNAMO D30

Caudal de aire: 19,100 CFM x 2.6" c.a.

Motor: 20 HP

Cantidad: 3 unidades

3.2.2. Selección de Equipos.-

Se adjuntan las Hojas de Selección Computarizada (Software) de los principales Equipos. Ver **Anexo B**

3.2.3.- Sistema de Control Inteligente .-

La implementación de un Sistema de Control Inteligente en una instalación de este tipo es importante y necesaria por lo siguiente:

- Permite al Operador mantener el Sistema dentro de las mejores condiciones de operación (temperatura, humedad, etc.), orientadas siempre al Ahorro de Energía.

- Es una ayuda permanente al personal de Mantenimiento pues previene acciones y anticipa revisiones y/o cambios de piezas y accesorios de los equipos pues es capaz de monitorear y llevar históricos de parámetros de operación y ver tendencias de los mismos.

- Ayuda en la Evaluación de Problemas pues permite ver la totalidad de los parámetros que asocian al equipo, área o zona en problemas.

- Permite actuar en forma inmediata ante la presencia de fallas en los equipos.
- Permite el acceso restringido a los usuarios es decir, solo las personas autorizadas tienen acceso al sistema y a manipular los parámetros de operación.

3.2.3.1 .- Descripción del Sistema de Control .-

Los componentes que incluimos para realizar esta funciones son:

1 panel global GCM-8600 con su transformador

10 paneles microprocesadores MZ2-1E con sus transformadores

21 sensores de flujo de aire PC-301

11 sensores de presión diferencial PP-8616 con sus transformadores, estos nos envían una señal analógica a los paneles microprocesadores donde se interpreta y ordena al variador de velocidad de la unidad manejadora reducir su velocidad y por consiguiente la potencia del motor.

6 sensores de flujo de agua FS-1

2 sensores de presión diferencial Dwyer 645 para agua (bombas secundarias). Estos sensores de presión diferencial detectan el aumento o disminución de la presión en la línea de agua en función de la demanda y envían una señal analógica a los paneles microprocesadores donde se interpreta y ordenan a los variadores de velocidad modificar la velocidad del motor de la bomba y por consiguiente un ahorro de la energía.

2 variadores de velocidad de 20 HP, 230V

10 variadores de velocidad de 7.5 HP, 230V

1 variador de velocidad de 10 HP, 230V

Además de estos sensores y controladores es necesario el Software respectivo y una interface gráfica amigable para el usuario, para lo cual se requiere los siguientes elementos:

1 computadora, printer y accesorios

1 software Signal de 20 pantallas, en ambiente Windows e información en tiempo real.

El Sistema Inteligente propuesto tiene por finalidad tener un mejor control del sistema en su conjunto así como un ahorro de energía debido a la optimización de parámetros y recursos.

Con este sistema se controla y monitorea los siguientes equipos del sistema de aire acondicionado

Se controla y monitorea los parámetros básicos de funcionamiento y operación de los chillers a través del OPM (Open Protocol Master), el cual entrelazará el sistema inteligente propio de cada chiller con el sistema de control instalado para toda la red de aire acondicionado.

El sistema de bombeo de agua helada es primario-secundario, en el cual las bombas primarias son de caudal constante y las de bombeo secundario son de caudal variable.

Para las bombas de agua helada primaria y las bombas de agua de condensación el sistema inteligente marcará el arranque y parada de las mismas e indicará el status de operación y emitirá una señal de alarma si es que ordenó el arranque de las bombas y el indicador del status muestra que está en off. Para las bombas de agua helada secundaria que funcionan con volumen variable, la variación del caudal es a través del variador de

frecuencia, que recibe una señal proporcional de un sensor diferencial de presión conectado en la red de tuberías de agua helada ya que al abrir o cerrase las válvulas de 2 vías la presión en la red de agua helada varía y el cambio es detectado por este sensor,

El agua es enviada a las Unidades Manejadoras de aire y fan coils que están en los diferentes pisos del edificio, Las manejadoras de Aire cuentan con unas válvulas de dos vías proporcionales, la cual abre o cierra según la señal que reciba de la temperatura del aire de suministro que se está enviando a la sala. El control del variador del volumen se realiza en forma similar a como se hace en las bombas de agua helada secundaria: un sensor diferencial de presión en la línea detecta el aumento o disminución de la presión en el ducto según se abra o cierren los dampers de control de zonas, los que son gobernados y controlados por termostatos ubicadas en cada zona en la que se dividió el piso. El arranque, parada, indicador de status y la alarma en las unidades manejadoras de aire, fan coil, extractores y ventiladores funcionan igual que para las electrobombas.

Instalada en la azotea se encuentran dos torres de enfriamiento las que se encargan de evacuar el calor que se genera en los chillers. El sistema inteligente ordena su arranque y parada.

Para los extractores de monóxido de carbono se tendrá solo un indicador de status pues la firma DMR se encargará de su control. (DMR tuvo el contrato por la automatización de los servicios complementarios del edificio: grupos electrógenos, iluminación, tableros eléctricos, etc,.)

La forma en que se instalan y conectan entre sí los distintos controles y dispositivos está indicada en los Planos C1, C2, C3, C4, C5 y SI-1 adjuntos.

3.2.3.2.- Dispositivos y Elementos de Control .-

Se presentan a continuación los principales controladores y elementos: sensores, actuadores, transmisores, etc.

Controlador de Red : Panel Global GCM-8600, que es el encargado de organizar y manejar el resto de controladores locales. Desde este controlador se puede tener acceso al resto de controladores locales sin necesidad de una PC, pero por motivos de facilidad de operación y para poder almacenar la data necesaria es que se precisa de estos periféricos: PC e impresora.

Panel Integrador SIM MTECH, este panel cumple la función de "traducir" el formato de comunicación que tienen los Microprocesadores de los Chillers McQuay para que pueda haber la comunicación con el Sistema de Siebe. Esta comunicación se da por intermedio del Panel McQuay OPM (Open Protocol Master)

Controladores Locales Microzone II, estos son controladores que tienen la programación para el control y operación de los distintos equipos a los que están conectados mediante sensores, actuadores, etc. pero que requieren de un controlador superior para coordinar esfuerzos (GCM 8600).

Sensor de presión Diferencial de Presión del tipo Digital para Aire : PC-301

Sensor de presión Diferencial de Presión del tipo Analógico para Aire : PP-8616

Sensor de presión Diferencial de Presión del tipo Digital para Agua: F61KB11

Sensor de presión Diferencial de Presión del tipo Analógico para Agua Dwyer 645-6

Sensor de Temperatura para inmersión en Ducto de Aire del tipo Analógico: TS-5721-850

Los catálogos y Hojas Técnicas en el Anexo C.

3.3.- Ingeniería de la Instalación .-

En esta sección se comentan los incidentes y características particulares de esta Instalación.

Por ser este un Proyecto en el cual se contrata a una empresa por el Suministro e Instalación de un Diseño ya establecido y coordinado en la mayoría de requerimientos por parte de la obra Civil como puntos de drenaje, puntos de alimentación eléctrica, cimentaciones especiales, etc. se comentarán los aportes al Proyecto y a la instalación así como las modificaciones que se tuvieron que realizar por limitaciones o incompatibilidades del Proyecto mismo.

En la Parte Mecánica se hicieron varias modificaciones "normales" dentro de este tipo de trabajos como cambiar algunas secciones de ducto, evadir algún obstáculo en el recorrido, mover difusores, etc. sin embargo hubo una que se merece ser tratada más al detalle:

De acuerdo a lo solicitado en el proyecto (ver 3.1.1) se debería tener un control de Entalpía de dos posiciones (on/off) que en caso de ser meritorio abra al 100% el damper de toma de aire fresco de las UMA y cierre completamente el damper colocado en el ducto de retorno de la Sala. Sin embargo ésto no es posible por las siguientes razones:

El tamaño de la toma de aire fresco no es suficiente para el caudal total de aire necesario pues ahora el equipo se comportaría como un sistema 100% de aire exterior.

Dado que el damper de retorno estaría cerrado para que el equipo tome 100% de aire exterior (de haberse solucionado el problema anterior) entonces sería necesario colocar un alivio de aire en cada piso pues de otra forma se estaría presurizando en forma por demás exagerada los distintos piso en cuestión.

Sería necesario en todo caso suministrar e instalar un extractor de aire que expulse este aire al exterior y mantener así una presión adecuada al interior de los ambientes climatizados.

Puesto que la solución pasaba por hacer modificaciones en la Arquitectura e instalaciones interiores y básicamente un desembolso de dinero adicional el Propietario se decidió en acuerdo con el Proyectista, Propietario y Contratista en no instalar dicho sistema y dejar los dampers en acción manual.

Se modificó además la secuencia de operación del Sistema pues de acuerdo éste la planta de frío debería arrancar apenas se lance un fan coil o unidad manejadora de aire lo cual no es viable puesto que estos equipos

requieren una carga mínima de operación (25% de capacidad de uno de los compresores) y por cortos periodos de tiempo lo cual no se da bajo este principio. Estos puntos serán tratados más adelante en la parte del Sistema de Control Inteligente.

Antes de pasar a las modificaciones en el sistema de Control Inteligente comentaremos un poco más los lazos principales de control de este sistema:

Control de Temperatura en los Ambientes Acondicionados de las Unidades Acondicionadoras de Aire (UMA).- Como se indicó anteriormente cada piso, para efectos de la distribución del Aire Acondicionado, está dividido en cuatro zonas atendidas cada una de ellas por un ducto de suministro de aire controlado por un damper en la salida de la UMA (Ver Planos). El accionamiento de esta damper es gobernado por una señal que le envía el termostato ubicado en cada zona y que es configurado a una condición de temperatura definida por los usuarios directamente sobre el termostato.

Control de temperatura en los Ambientes Acondicionados por Fan Coils.- El control se realiza a través del termostato de ambiente que abre o cierra la válvula de dos vías que controla el paso de agua helada al equipo.

Control de Temperatura de Suministro de Aire.- Por ser éste un sistema de volumen variable para la distribución de aire, es fundamental que la temperatura de suministro de aire se mantenga constante. Ésto se logra cuando se coloca un sensor de temperatura en el ducto de suministro de aire a la salida del serpentín de enfriamiento de la UMA, este sensor transmite la

información al controlador respectivo y se evalúa la información recolectada, como respuesta a esta señal analógica el controlador actúa sobre la válvula de dos vías permitiendo o no el ingreso de agua helada pudiendo así mantener constante las condiciones del aire de suministro.

Control de Caudal de Aire en las Unidades Manejadoras de Aire.- La variación del caudal de aire se logra a través de un Variador de frecuencia que modifica la velocidad de rotación del motor modificando a su vez el caudal de aire insuflado. La señal que manda sobre el variador viene de un sensor de presión estática del tipo analógico que sensa la presión en el ducto y la envía al controlador respectivo. En el controlador éste la compara con el valor del set point respectivo y envía la señal correctiva para oponerse al cambio es decir, si la presión se incrementa por sobre el set point entonces disminuye las revoluciones y si la presión disminuye entonces incrementa la velocidad de giro del motor para compensar el cambio.

Status de Operación de las Unidades Manejadoras de aire, Fan Coils y Equipos de Ventilación.- Sirve para verificar si el equipo está operando o no, y se hace a través de un sensor de presión estática de tipo digital que se coloca a la salida del equipo y entrega un On si detecta una presión mínima en el ducto lo cual significa que existe flujo de aire y el ventilador del equipo está operando, mientras no detecte la señal mínima de presión considera que el ventilador está apagado. Si previamente recibió la señal de arranque y la señal de este sensor sigue siendo Off entonces se emitirá una alarma para este equipo en la consola de control.

Control de Caudal de Agua en las Bombas de Agua Secundarias.- Al igual que en las UMA´s se dispone de un sensor de presión analógico en las línea de agua helada que reporta a un controlador y éste envía la señal requerida al respectivo variador de velocidad.

Status de operación de las Bombas de Agua.- Se realiza en forma similar que en los ventiladores sólo que es dispositivo especial para agua.

Planta de Frío.- Distinto a la forma que indicaba el Proyecto se hicieron algunas modificaciones a los criterios de Operación de la Planta de Frío ajustándonos a lo solicitado por el Cliente y a lo Técnicamente requerido.

El Chiller posee su propio Microprocesador que controla su funcionamiento y operación para que se mantenga dentro de sus parámetros normales de operación. Aprovechando estas bondades el Chiller opera en forma autónoma y es el Sistema Inteligente central el que le da la "habilitación" para que pueda entrar en operación.

El Chiller además tiene entre sus recursos el control de sus respectivas bombas de agua helada y de condensación para seguir la secuencia de arranque es decir, activa primero las bombas de condensación y luego las de agua helada y cuando confirmó flujo en los intercambiadores de calor (evaporador y condensador) es que lanza los compresores.

La Torre de Enfriamiento entra en operación (el ventilador) por un control de presión de condensación en el chiller con lo cual se logra mantener las condiciones en un estado óptimo y con ahorro de energía.

El Sistema de Control Inteligente tiene acceso de sólo lectura al Panel microprocesador del Chiller ya que el personal operador del sistema (en la consola) no es necesariamente capacitado para manejar e interpretar los diferentes parámetros y variables de este tipo de sistema por lo que se corre el riesgo de una mala operación.

El horario de funcionamiento es definido en el Chiller mismo (microprocesador) y cualquier cambio de éste se coordina con anticipación para hacer la variación respectiva.

Por requerimientos del Propietario el Sistema Inteligente del Edificio debe ser Centralizado lo cual significaba que los sistemas deberían estar integrados: iluminación, tableros eléctricos, grupos electrógenos, ascensores, aire acondicionado, etc. Ésto lamentablemente no se puede realizar tan fácilmente por que al tener dos Contratistas para Dos Sistemas de Control (por un lado Termosistemas/Siebe para la parte del Aire Acondicionado y por otro DMR/Johnson Controls para la parte de Servicios Complementarios) con productos y protocolos de comunicación diferentes e incompatibles, era prácticamente imposible hacer esta integración tal y como la solicitaba el Propietario. Sin embargo se llegó a una solución aceptada por todos: la comunicación de los Sistemas se plantearía para el Tema de Ahorro de Energía del Edificio es decir, se plantearon tres niveles de consumo de energía en el Sistema Johnson Controls y por cada nivel que se superase se daría una señal al Sistema de Siebe en forma de señal digital con lo cual se le aumentaría un grado Farenhait al set point de Agua Helada

para disminuir el consumo del Chiller que es al final de cuentas el que tiene más consumo en un Sistema de Aire Acondicionado.

CAPÍTULO IV

ESTRUCTURA DE COSTOS

4.1 .- Costo del Proyecto .-

Ver Presupuesto ejecutado en Anexo D

4.2 .-Criterios para Estimar el Costo/Beneficio en un Sistema de Aire Acondicionado

Hacer el Costo/beneficio en un Sistema de Aire Acondicionado es bastante relativo pues el beneficio está representado finalmente por el incremento de la Productividad del Personal que está laborando o va a laborar y en otro por la comodidad que le puede ofrecer a sus Clientes cuando va a sus oficinas a realizar algún trámite en particular.

Como vemos son factores que no son fácilmente cuantificables pero tomaremos algunos datos proporcionados por BOMA (Building Owners and Managers Association) asociación americana de propietarios y administradores de edificios, quienes analizan el incremento de productividad en el personal en base a facilidades que se le pueda dar al personal y obtuvieron lo siguiente:

- Elevadores: Aumento del 11% en Productividad.
- Sistemas de Aire Acondicionado: Aumento en 18% en Productividad.

- Calidad de Aire: Aumento en 21% en Productividad.
- Acústica: Aumento en 26% de productividad.

Esto nos da una idea de los beneficios de un Sistema de Aire Acondicionado conveniente diseñado e instalado, además de cómo mencionáramos antes factores difícilmente cuantificables como el confort y comodidad delos usuarios y clientes del edificio.

CONCLUSIONES

1.- El Proyecto fue Ejecutado adecuadamente y está operando a plena satisfacción del Propietario.

2.- Las modificaciones realizadas al Proyecto están trabajando como era de esperar, previniendo problemas futuros y gastos inútiles.

3.- La correcta práctica de la ingeniería así como el empleo adecuado de materiales y herramientas por personal técnico capacitado nos garantiza una instalación óptima desde todo punto de vista.

4.- El personal técnico nacional es capaz de asimilar rápidamente las nuevas tecnologías y técnicas que llegan a nosotros vía Proyectos de Envergadura y adecuada capacitación.

5.- Es imprescindible que la Elaboración de Proyectos (Cálculo, Análisis y Diseño de Sistemas de este tipo) así como la ejecución e instalación de estos sistemas sea hecha por personal y empresas con cuenten con la experiencia y conocimientos necesaria para dar soluciones técnica y económicamente adecuadas al Cliente

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ANEXO A

ESPECIFICACIONES TÉCNICAS

1.3 MEMORIA DESCRIPTIVA DE LAS INSTALACIONES MECANICAS.-

1.3.1 GENERALIDADES.-

La presente Memoria Descriptiva define las características generales, parámetros y criterios de diseño para las Instalaciones Mecánicas del proyecto correspondiente a la oficina Corporativa Grimaldo del Solar de Telefónica del Perú ubicada en la esquina de Grimaldo del Solar con Av. Benavides.

Las Instalaciones Mecánicas involucradas en el presente Estudio, comprenden:

- Sistema de Aire Acondicionado
- Sistema de Ventilación
- Sistema de Petróleo
- Sistema de Gas Propano
- Equipamiento de Cocina

1.3.2 DESCRIPCIÓN DE INSTALACIONES.-

1.3.2.1 Sistema de Aire Acondicionado.-

Corresponde al Proyecto de Aire Acondicionado del Edificio para lo cual se adjuntan parámetros de cálculo y descripción del sistema a implementar.

1.3.2.1.1 Parámetros de Diseño.-

Los siguientes son los parámetros utilizados en el cálculo del Aire Acondicionado:

Condiciones Exteriores	:	86^0 F Bulbo Seco 80% Humedad Relativa
Condiciones Interiores	:	72^0 F Bulbo Seco 50% Humedad Relativa

Coeficientes globales de transmisión:

. Pared Exterior	:	0.40 BTU/H - pie2- ^{0}F
. Pared Interior	:	0.37 BTU/H - pie2- ^{0}F
. Piso y techo interior	:	0.43 BTU/H - pie2- ^{0}F
. Techo Exterior	:	0.45 BTU/H - pie2- ^{0}F
. Vidrio Interior	:	1.20 BTU/H - pie2- ^{0}F

Ganancias por ocupantes:

. Sensible	:	250 BTU/H
. Latente	:	220 BTU/H

Cargas por Iluminación : 15 w/m^2

Aire de renovación : 15 CFM/persona

1.3.2.1.2 Carga Térmica.-

El cálculo de la carga térmica se ha efectuado teniendo como base los parámetros de diseño y siguiendo la metodología de la ASHRAE.

La capacidad total calculada en el Edificio es de 335 Ton. de refrigeración, sin embargo se ha considerado un factor de simultaneidad de 0.9, con lo cual la capacidad es de 335 x 0.90 = 301 Ton., por tanto se ha considerado para efectos del diseño una capacidad total de 300 Ton. de refrigeración.

1.3.2.1.3 Descripción General del Sistema.-

El sistema de Aire Acondicionado previsto es del tipo AGUA- AGUA, considerando dos unidades centrales de agua helada (chillers) de 150 ton. cada una. refrigerados por agua cuyas ubicaciones son en el cuarto sótano del Edificio.
Los chillers se han previsto instalados en paralelo de manera que funcionen ambos o uno de ellos para cualquiera de los pisos, según la demanda lo requiera.

Los chillers serán refrigerados por agua para lo cual se instalarán sobre el techo del edificio dos torres de enfriamiento de 150 Ton de capacidad, con una montante de agua de condensación y retorno instalado en ducto de mampostería.

La recirculación de agua helada se realizará a través de electrobombas de agua helada de tipo volumen variable y presión constante para la red secundaria, 1 por cada unidad chiller y de la capacidad total de refrigeración, se ha previsto además el espacio para una tercera bomba, que estaría en Stand - by.

Se ha previsto además la instalación de electrobombas de volumen constante para recirculación a través de chillers (red primaria).

El sistema de tuberías a instalar es de retorno directo con válvula de 2 vías, todas las tuberías estarán debidamente aisladas y equipadas con válvulas de control para regulación de caudal mediante microprocesador.

En general en el edificio se instalarán unidades evaporadoras del tipo simple zona para instalación vertical . en salas ubicadas en cada piso, salvo el primer piso que tendrá unidades Foin-coil , colgada sobre el F.C.R.

Desde las unidades manejadoras o fan-coils saldrán los ductos de suministro de aire en plancha galvanizada y aislados con planchas fibra de vidrio de 1" de espesor, aislándose los primeros 6 mts. con aislamiento interior para eliminación de ruido en los ductos.

Se ha previsto la distribución de los ductos en forma sectorizada de manera de instalar dampers motorizados que regularán mediante termostatos de forma de mantener hasta 4 zonas con temperaturas independientes.

El retorno del aire se ejecutará considerando el FCR como plenums de retorno para lo cual se ha instalado ducto de plancha galvanizada de manera de conectar el plenum con la sala de máquinas.

En lo que respecta a la renovación del aire del 1° Piso se ha previsto instalar cerca de cada sala un inyector de aire tipo centrifugo y un ducto galvanizado que permite inyectar aire del exterior a través de rejillas sobre el F.C.R., para los demás pisos, las salas de Airte Acondicionado tiene una rejilla con damper para toma de aire del exterior.

Para el control de la temperatura se instalarán sensores (termostatos) que regularán los motores dampers de cada zona tal como se observa en los planos.

1.3.1.4 Ahorro de Energía.-

El ahorro de energía se efectuará mediante dos formas :

- Electrobombas de volumen variable y presión constante.
- Sistema inteligente.

El control se efectuará a través de válvulas de dos vías, la cual se abre o cierra según la carga aumente o disminuye. Además se instalará un sensor de diferencia de presión entre la entrada y la salida de cada unidad manejadora o Fan-coil, mediante la cual se reducirá la velocidad de la bomba secundana según se requiera mayor o menor caudal de agua helada, pudiéndose de esta manera ahorrar energia, por lo tanto las bombas secundarias serán del tipo vanable, mientras que existirán otras bombas primarias que serán de volumen constante y que serán utilizados para vencer la caída de presión en los chillers.

Se preveerá además un sistema de control inteligente para control de unidades centrales, electrobombas de agua helada, unidades manejadoras y torres de enfriamiento.

La secundaria de operación será :

a) Unidades Manejadoras (UM)

El programa de arranque y parada automática pondrá en marcha cada UM, basado en un programa previamente establecido.

Cuando cualquiera de las UM es arrancada, el sistema inteligente pondrá en marcha la planta de agua helada, activando primero la bomba de agua y después que el sistema recibe la confirmación de que existe caudal de agua, el panel de control del enfriador es activado, un sensor de presión en el ducho de suministro indicará la existencia de caudal de aire, en el caso de que la unidad no arranque, se genera un alarma a través de un panel localizado en el área de mantenimiento.

Un control de entalpía de dos posiciones está localizada en la toma exterior, enviando una señal al sistema de control, el cual dicha señal con las condiciones internas del edificio, en caso que las conclusiones externas e internas lo justifiquen, la compuerta de aire de retomo se cerrará y la de aire exterior se abrirá para permitir que 100 % de aire exterior entre en el edificio.

b) Planta de Agua Helada.-

Las bombas de agua helada se alternarán automáticamente y en caso de que falle alguna, arrancará la otra, en caso de que falle alguno de los enfriadores, será indicada una alarma general en el panel central.

1.3.2.2 **Sistema de Ventilación.-**

El sistema de ventilación de los sótanos será por medio de Extractores Centrífugos a ser ubicados en el 5° sótano en un ambiente destinado para la ubicación de estos equipos, la toma de aire se ejecutaría por medio de rejillas en piso y ductos enterrados de mampostería conectadas con Sala de Equipos de Extracción. La descarga del aire se hará a través de ducto de plancha galvanizada hacia el exterior.

2.3. ESPECIFICACIONES GENERALES DE LAS INSTALACIONES MECANICAS.-

2.3.1 VENTILACIÓN DE SÓTANOS.-

2.3.1.1 Extractor Centrífugo.-

Ventilador centrífugo totalmente equipado en fábrica. listo para funcionar una vez instalado.

El tipo será centrífugo, eje horizontal, con los alabes curvados hacia adelante. de simple entrada.

Las características de capacidad, están indicadas en el cuadro de características de equipos indicado en los planos. La caída de presión exterior indicada en el cuadro de capacidades solo incluye pérdidas en ductos y rejillas.

El ventilador será construido y aprobado de acuerdo con las normas internacionales vigentes, tal como AMCA o similar y nacionales vigentes. Construcción de fácil reemplazo de las partes, debiéndose realizar pruebas estrictas en fábrica de acuerdo con las normas.

La unidad estará compuesta por un ventilador extractor, que incluye impelente y carcaza y una armadura soporte de la unidad provista de tapas de protección, sistema de accionamiento compuesto por el motor eléctrico. poleas, fajas y eje.

El ventilador deberá ser de bajo nivel de sonido será fabricado íntegramente de planchas de acero negro.

El impelente tendrá hojas inclinadas hacia adelante y deberá ser balanceado estática y dinámicamente en fábrica.

La carcaza será de diseño aerodinámico, llevará collares integrados a la entrada y salida de aire para una fácil instalación al ducto de entrada y descarga de aire.

Tendrá además perfiles de refuerzo de acero negro, soldados.

El motor eléctrico será construido según standard NEMA, para conectarse a la red de 220 V, 60 Hz, 3 fases ó 1 fase, girando a 1750 RPM, cuya potencia será mayor al BHP requerido por el ventilador.

Deberá ser del tipo abierto con ventilación incorporada, con protección contra goteos y salpicaduras, el aislamiento será clase F para uso tropical.

El accionamiento del rodete será mediante un sistema de poleas acanaladas de paso regulable para permitir variación del caudal y fajas en "V", seleccionadas de acuerdo a la potencia y velocidad del motor con un factor de seguridad mínima de 1.4.

Las poleas serán fijadas al eje mediante chavetas de sección cuadrada.

El sistema de regulación de tensión de la faja se hará desplazando el motor sobre unos rieles acanalados y ajustados mediante pernos a su base.

El rodete estará fijado a un eje de acero de alta resistencia y éste estará soportado por dos chumaceras con rodamientos auto alineantes, de larga duración, lubricados con grasa, sellados para evitar contaminaciones.

El ventilador estará montado y empernado sobre un bastidor construido de planchas dobladas y perfiles de acero soldadas entre sí.

La base del motor estará soportado por unos rieles ubicados a media altura del bastidor en los cuáles se podrá desplazar para efectos de su regulación.

Así mismo las chumaceras descansarán sobre la parte superior del bastidor y estarán fijadas mediante pernos.

El bastidor dispondrá en su base para ser anclados a la cimentación.

El acabado final de las planchas y estructura será con dos manos de pintura anticorrosiva y dos de esmalte final.

Las soldaduras y elementos no galvanizados serán galvanizados previamente en frío con base de zinc-epóxica.

Se suministrará un arrancador magnético directo, con contactos auxiliares para mando a distancia, con protección térmica contra sobre carga en las tres fases y botonera de mando arranque parada en gabinete de acero esmaltado al horno. En capacidades de acuerdo con la capacidad del motor. Deberá incluirse el microprocesador o PLC respectivo para procesar las señales de operación o falla.

Se suministrará asimismo las conexiones eléctricas desde el tablero dejado por el contratista, en conductores THW, y con tubería de fierro galvanizado flexible, que deberán estar conformes con el C.E.P.

2.3.1.2 Ductos Subterráneos.-

Construidos por la obra civil en los recorridos y dimensiones indicados, interiormente deberán tener las capas pulidas y conservar la forma rectangular de su sección para lo cual se deberá coordinar debidamente con la ubicación de columnas, zapatas y sobrecimientos.

2.3.1.3 Damper de Regulación.-

En los lugares previos a rejillas de extracción de piso de los ductos subterráneos se deberá instalar reguladores metálicos de caudal con dispositivos de ajuste de la hoja para 25, 50 75 y 100%, tal como se muestra en detalles.

2.3.1.4 Rejillas en Pisos.-

Serán de las dimensiones indicadas en plano y construidas con platinas de acero negro de 2" x 1/4", galvanizadas íntegramente y con acabado de esmalte epóxico negro.

2.3.2 SISTEMA DE AIRE ACONDICIONADO

2.3.2.1 Chiller Enfriador de Agua.-

Enfriador de agua totalmente equipado en fábrica, listo para funcionar una vez instalado para trabajar a nivel del mar.

Serán tipo tornillo con condensador enfriado por agua, incluyendo todos los equipos para el ciclo de refrigeración en un solo paquete con refrigerante HFC-134a, o R-123.

La unidad tendrá 150 toneladas de refrigeración mínimo. desde una temperatura del aire exterior de hasta 85°F con un flujo de agua a razón de 2.4 gpm/ton a 44°F.

La unidad comprende compresores gemelos semi-herméticos tipo tornillo, intercambiadores de agua helada - refrigerante y agua de condensación-refrigerante con sus unidades de ventilación forzada, tuberías para el refrigerante con su válvula de expansión, así mismo los controles y accesorios para su instalación completa, según se detalla más adelante. Todo ello ensamblado en un gabinete metálico.

Condiciones eléctricas del lugar 220 V. 60 c. 3 fases.

El gabinete tendrá una estructura angular de acero de 1/4" de espesor, aproximadamente, con sus uniones electrosoldadas, con paneles de planchas de acero de 2 mm. de espesor y fijados a la estructura mediante tornillos. Estará protegido por dos capas de pintura anticorrosiva y esmalte.

a) Compresor y Motor.

Deberán ser del tipo tornillo compresores gemelos semi-herméticos con silenciador interno y válvula check, diseñado para un funcionamiento silencioso y para comprimir R-134a o R-123 en rangos de presión resultantes de las temperaturas de succión y descarga indicadas. La carcaza y los cilindros serán de fundición, todas las partes tendrán un circuito para su correcta lubricación la que será impulsada por una bomba de desplazamiento positivo, autocebante desde el cárter de almacenamiento, vendrá equipada con un visor para el nivel de aceite y un colador en la succión. El cárter tendrá tapas de inspección y un calentador de aceite incorporado el cual regula la viscosidad del aceite antes del arranque.
El motor eléctrico será hermético de alto toque para trabajo pesado, operará a 1750 rpm., podrá ser enfriado por el gas el cual circulará entre el estator y el rotor. Con capacidad para trabajar en un +/- 10% de la tensión de la placa y tendrá un sistema de protección de sobre carga de estado sólido en el tablero de control.

b) Evaporador.-

Será del tipo de expansión directa, los tubos del evaporador serán de cobre sin costura, expandidos en sus terminales a las planchas de fijación, de acuerdo al código ASME para recipientes a presión no inflamables, diseñado para la presión de trabajo de 225 PSIG. en el lado de agua con pruebas hidráulicas según normas. El aislamiento exterior será a base cloruro de polivinilo con un espesor mínimo de 3/4" (K=0.28).

El evaporador será protegido contra congelamiento mediante calentadores de resistencias eléctricas. Las válvulas de drenaje de agua serán incluidas.

Deberá incluir dos circuitos independientes de refrigerante, además de un punto de drenaje y alivio para el evaporador.

c) Condensador.-

Los serpentines del condensador enfriados por agua -serán de tubos de cobre sin costura con aletas de aluminio ajustadas mecánicamente.

El condensador será aislado con espuma de cloruro de polyvinilo de célula cerrada de 3/4" (K= 0.28).

d) Panel de Control.-

Panel de control con protección contra intemperie, tendrá puerta abisagrada para acceso; con los siguientes instrumentos, controles, y dispositivos de seguridad:

- Manómetros indicadores de la presión de evaporación y condensación.
- Manómetros indicadores de la presión de succión y descarga de aceite.
- Interruptor de seguridad controladores de baja y alta presión del refrigerante.
- Interruptor de seguridad de baja presión de aceite.
- Interruptor de alta temperatura del motor.
- Termostato controlador de temperatura de agua helada en el retorno para parada y arranque del compresor.
- Interruptores de flujo de agua helada.
- Horómetro.
- Ahorrador de energía.
- Panel de control electrónico con "Microprocesador", switch Local/off/remote, y pantalla de diagnóstico en 2 líneas de 24 caracteres por línea con teclado.

Debe ser capaz de llevar a cabo las siguientes funciones:

- Cambio automático de compresor líder/esclavo
- Control de capacidad basado en la temperatura de salida del fluído enfriado en cuenta la temperatura de retorno del fluido
- Limitar la pendiente de ajuste a la temperatura del fluido enfriado en el arranque en un rango ajustable de 0.11° C a 1.1° C (0.2° F a 2° F) por minuto para prevenir excesivos picos de demanda al arranque.
- Programación de tiempos de arranque/parada de siete días para bombas y chillers.

e) Panel de Fuerza.-

Panel de fuerza en gabinete metálico con acabado anticorrosivo, deberá incluir los siguientes elementos:

- Interruptor magnético de 220 VAC.
- Arrancador por autotransformador además de contactores magnéticos temporizador y relés térmicos de sobrecarga.
- Botoneras de arranque y parada, luces de señalización integrada con las torres de enfriamiento.
- Secuencializador automático de arranque.
- Dispositivos completos para la desconexión y alarma visual audible del equipo por las anormalidades detectadas de los sensores.
- Alambrado en fábrica y borneras de fuerza y de control.

f) Diagnósticos.-

El módulo de visualización de datos, debe ser capaz de mostrar, puntos de ajuste, tiempo, estado del sistema (incluyendo temperaturas, presiones y porcentajes de carga), y cualquier alarma o condición de alerta.

El módulo de control, unido al microprocesador, debe ser capaz de mostrar las salidas del test de arranque para verificar la operación de todos los switch, sensores, potenciómetros, ventiladores y compresores antes del arranque del chiller.

g) Seguridades.-

La unidad debe estar equipada con todos los componentes necesarios, y unidos al sistema de control deberán proveer a la unidad protección para enfrentar lo siguiente:

Pérdida de carga de refrigerante
Rotación inversa
Baja temperatura de fluido enfriado
Baja presión de aceite (en cada circuito)
Desbalance de voltaje
Corriente a tierra
Sobrecarga térmica
Alta presión sobrecarga eléctrica
Pérdida de fase
Desbalance de corriente

h) Características de Operación.-

La unidad debe ser capaz de arrancar con temperaturas de agua de entrada al evaporador de hasta 35°C (95° F).

El postor deberá incluir en su propuesta, catálogos y especificaciones completas de cada uno de los equipos y accesorios a instalarse.

El fabricante deberá proveer luego de la aceptación de la propuesta catálogos y manuales de operación y mantenimiento de cada componente, catálogo de partes y lista completa de repuestos de los que debe asegurar su suministro.

2.3.2.2 Unidad Acondicionadora.-

Cada unidad de aire acondicionado será totalmente equipada en fábrica, lista para funcionar una vez instalada.

Será una unidad tipo "Manejadora de Aire" (Air Handling), simplezona.

Las características de cada equipo están indicados en el cuadro general de equipos, mostrada en planos.

La unidad será fabricada y probada de acuerdo con las normas internacionales vigentes tales como ASHRAE, AMCA o similar vigentes. Construcción de fácil reemplazo de las partes, debiéndose realizar pruebas estrictas en fábrica de acuerdo con las normas.

La unidad de refrigeración estará compuesta básicamente por una unidad de ventilación simple o duplex, accionados por motor eléctrico, un serpentín de enfriamiento con agua helada, en un gabinete de acero.

Los ventiladores deberán ser tipo centrífugo de bajo nivel de sonido de 61 a 65 máximo. Será fabricado íntegramente de planchas de acero galvanizado.
Velocidad de descarga máxima de 1800 FPM.

El impelente tendrá aletas inclinadas hacia adelante y deberá ser balanceado estática y dinámicamente en fábrica.
La carcaza será de diseño aerodinámico.

Tendrá además perfiles de refuerzo de acero galvanizado, soldados y sujeción de la carcaza al gabinete.

El motor eléctrico será construido según standard NEMA, para conectarse a la red de 220 v. 60 Hz., 3 fases, girando a 1750 RPM. cuya potencia será mayor al BHP requerido por el ventilador.

Deberá ser del tipo abierto con ventilación incorporada, con protección contra goteos y salpicaduras, el aislamiento será clase F. para uso tropical.

El accionamiento del rodete será mediante un sistema de poleas acanaladas, de paso regulable para permitir variación del caudal y fajas en "V", seleccionadas de acuerdo a la potencia y velocidad del motor con un factor de seguridad mínimo de 1.4.

Las poleas serán fijadas al eje mediante chavetas de sección cuadrada.

El sistema de regulación de tensión de la faja se hará desplazando el motor sobre unos rieles acanalados y ajustados mediante pernos a su base.

Los rodetes estarán fijados a un eje de acero de alta resistencia mediante chavetas o prisionero y este estará soportado por dos o mas chumaceras con rodamientos auto- alineantes, de larga duración, lubricados con grasa, sellados para evitar contaminaciones.

El serpentín de enfriamiento será construido con tubos de cobre tipo "K" sin costura y aletas de aluminio. Será seleccionado para una velocidad de paso de aire no mayor de 525 pies/min. y con un flujo de agua a razón de 2.4 GPM. por tonelada de refrigeración y temperatura de ingreso de agua de 42°F.

El serpentín no deberá producir caída de presión mayores de 20 pies de el flujo de agua determinado.

El filtro de aire será del tipo lavable de 2" de espesor construido de un conjunto de mallas especiales de aluminio traslapadas para un régimen de retención de polvo no menor de 180 gr/pie 2. y 70% de eficiencia a una velocidad de paso de aire de 500 pies/min. instalado a los canales portafiltros del gabinete.

La unidad contará con compuertas tipo persiana, construidas con plancha de acero galvanizado esmaltado que modulan la temperatura de aire de salida del equipo restringido o aumentando el paso de aire por el serpentín y al mismo tiempo aumentando o restringiendo, respectivamente, el paso de aire directo hacia la descarga. Estas compuertas contarán con los mecanismos de accionamiento para ser operados por un modutrol.

El gabinete comprenderá de una estructura angular de acero y recubrimiento de planchas de acero galvanizado debidamente entornillados a la estructura mediante tornillos autorroscantes cadmiados. El gabinete deberá tener dimensiones convenientes de acuerdo a las velocidades de flujo de aire y recomendaciones de normas descritas.

Será totalmente aislado con lana de vidrio tipo compacta de 1" de espesor material equivalente debidamente protegido con malla de alambre y láminas de plástico.

Tendrá bocas con collares para la descarga del aire.

El acabado de ventiladores, estructura, compuertas y gabinete será con dos manos de pintura anticorrosiva y dos manos de esmalte.

Esta unidad podrá ser instalada en el exterior del gabinete y contará con bandeja de recolección con plancha de aluminio.

Los equipos incluirán un termostato, detector de humos en el retorno y con damper de cierre del equipo en caso de la actuación de los primeros, estas unidades darán la alarma respectiva.

Se suministrará un arrancador magnético directo para motores de hasta 6 HP. inclusive, y sistemas de arranque estrella triángulo para mayores, con contactos auxiliares para energizar la válvula solenoide para mando a distancia, con protección térmica contra sobre carga en las tres fases y botonera de mando arranque-parada en gabinete de acero esmaltado al horno. En capacidades de acuerdo con la capacidad del motor.

Se suministrara asimismo las conexiones eléctricas, en conductores THW. y con tubería de fierro galvanizado, que deberán estar conformes con el C.E.P.

El postor deberá incluir en su propuesta, catálogos y especificaciones completas de los equipos, accesorios a instalarse, con las curvas de funcionamiento del extractor.

El fabricante, deberá proveer luego de la aceptación de la propuesta, catálogos y manuales de operación y mantenimiento de cada componente, diseño y recomendaciones de montaje, catálogos y partes y lista completa de repuestos los que debe asegurar su suministro.

2.3.2.3 Electrobombas de Agua Helada.-

- Bomba para recirculación de agua helada totalmente equipada por su fabricantes, lista para funcionar una vez instalada.

- El tipo será bomba centrífuga, eje horizontal de impelente rotativo, impulsada por motor eléctrico.

- El líquido a bombear será agua helada.

- El caudal será de 360 G.P.M.

- Altura dinámica total de 90 pies.

- La velocidad de la bomba deberá ser de 1750 RPM máximo.

- El máximo NPSH permitido será de 20 pies de agua.

- La bomba será construida de acuerdo a las normas internacionales vigentes. Construcción de fácil reemplazo de las partes, debiéndose realizar pruebas estrictas en fábrica de acuerdo con las normas.

  La caja y el impelente serán construidos de fierro fundido de alta calidad y resistencia a la tensión, diseñados para la máxima eficiencia de bombeo. El impelente será maquinado y balanceado estática y dinámicamente.

- La bomba llevará conexiones de tuberías para la succión y descarga con bridas según especificaciones ANSI B16.5. o similar. Además estará provisto de una base unido a la carcaza de la bomba, del mismo material para su instalación.

- Estará provisto de sello de prensa estopas con empaque de asbesto grafitado para temperaturas de trabajo de hasta 250°F.

  Serán resistentes a la abrasión y corrosión y de fácil mantenimiento.

  Los rodamientos estarán fijados en un block de fierro fundido y serán del tipo de bolas, lubricados con grasa y protegidos del polvo mediante sellos en las tapas.

- Deberá tener estricto acabado anticorrosivo y acabado final con esmalte.

- El motor eléctrico, será construido según Standard NEMA., de 20 HP mínimo a 1800 RPM., 3 fases, 60 c/s. 220 voltios.
  Deberá tener ventilación propia y protegido de goteos y salpicaduras. El aislamiento será tropicalizado.

El acoplamiento de motor a bomba será directo, tipo flexible, diseñado adecuadamente para la carga de la bomba y velocidad del motor y estará protegido por una cubierta de seguridad.

- Las bombas serán instaladas y alineadas sobre una base de concreto montada sobre resortes aisladores de 1-1/2" de deflexión. La base debe tener dos veces el peso combinado de la bomba, motor y base que sostiene.
  Se instalarán conexiones flexibles en la succión y descarga de bomba.

- El motor y la bomba estarán montados sobre una base común fabricada en acero, provista de agujeros para anclaje. Tendrá tratamiento anticorrosivo y acabado en esmalte.

- El postor deberá incluir en su propuesta, catálogos y especificaciones completas de cada uno de los equipos, accesorios a instalarse, con las curvas de funcionamiento de la bomba.

- El fabricante deberá proveer luego de la aceptación de la propuesta, catálogos y manuales de operación y mantenimiento de cada componente, diseño y recomendaciones de montaje, catálogos de partes y lista completa de repuestos los que debe asegurar su suministro.

2.3.2.4 **Electrobombas de Agua de Condensación.-**

- Bomba para recirculación de agua de condensación totalmente equipada por su fabricantes, lista para funcionar una vez instalada.

- El tipo será bomba centrífuga, eje horizontal de impelente rotativo, impulsada por motor eléctrico

- El líquido a bombear será agua helada.

- El caudal será de 450 G.P.M.

- Altura dinámica total de 120 pies.

- La velocidad de la bomba deberá ser de 1750 RPM máximo.

- El máximo NPSH permitido será de 20 pies de agua.

La bomba será construida de acuerdo a las normas internacionales vigentes. Construcción de fácil reemplazo de las partes, debiéndose realizar pruebas estrictas en fábrica de acuerdo con las normas.
La caja y el impelente serán construidos de fierro fundido de alta calidad y resistencia a la tensión, diseñados para la máxima eficiencia de bombeo. El impelente será maquinado y balanceado estática y dinámicamente.

- La bomba llevará conexiones de tuberías para la succión y descarga con bridas según especificaciones. ANSI B16.5. o similar. Además estará provisto de una base unido a la carcaza de la bomba, del mismo material para su instalación.

- Estará provisto de sello de prensa estopas con empaque de asbesto grafitado para temperaturas de trabajo de hasta 250°F.

Serán resistentes a la abrasión y corrosión y de fácil mantenimiento.

Los rodamientos estarán fijados en un block de fierro fundido y serán del tipo de bolas, lubricados con grasa y protegidos del polvo mediante sellos en las tapas.

- Deberá tener estricto acabado anticorrosivo y acabado final con esmalte.

- El motor eléctrico, será construido según Standard NEMA.. de 22 HP. mínimo a 1800 RPM., 3 fases, 60 c/s. 220 voltios.
Deberá tener ventilación propia y protegido de goteos y salpicaduras. El aislamiento será tropicalizado.

- Las bombas serán instaladas y alineadas sobre una base de concreto montada sobre resortes aisladores de 1-1/2" de deflexión. La base debe tener dos veces el peso combinado de la bomba, motor y base que sostiene.
Se instalarán conexiones flexibles en la succión y descarga de bomba.

- El acoplamiento de motor a bomba será directo, tipo flexible, diseñado adecuadamente para la carga de la bomba y velocidad del motor y estará protegido por una cubierta de seguridad.

- El motor y la bomba estarán montados sobre una base común fabricada en acero, provista de agujeros para anclaje. Tendrá tratamiento anticorrosivo y acabado en esmalte.

- El postor deberá incluir en su propuesta, catálogos y especificaciones completas de cada uno de los equipos, accesorios a instalarse, con las curvas de funcionamiento de la bomba.

El fabricante deberá proveer luego de la aceptación de la propuesta, catálogos y manuales de operación y mantenimiento de cada componente, diseño y recomendaciones de montaje, catálogos de partes y lista completa de repuestos los que debe asegurar su suministro.

2.3.2.5 Torre de Enfriamiento.-

La torre de enfriamiento será de tiro inducido, diseño tipo "botella" con entrada de aire de 360°, ventilador axial y descarga vertical, de 150 toneladas de capacidad, armadura estructural y paneles de la carcaza deben ser diseñadas para operación con carga y debe ser capaz de soportar velocidades del viento hasta 200 km/h.

Carcaza moldeada de material de poliester de fibra de vidrio reforzada (FBP) resistente a la corrosión; fabricada de una sola pieza.

La bandeja también moldeada de una sola pieza y de poliester de fibra de vidrio reforzada (FRP), bandeja provista con conexiones por ingreso de agua de 8" Ø, salida de agua de 8" Ø, agua por reposición de 1.1/4" Ø rebose y drenaje de 3" Ø.

Deberá incluir los siguientes accesorios mínimos : colador, válvula de reposición con flotador y dispositivo para regular el nivel del agua.

El llenado en tubería de PVC con arreglo circular, de calidad retardante a la flama tipo ASTM Standard E - 84 con rango menor a 25.

El ventilador será del tipo axial de aletas múltiples indicadas, para trabajo pesado; con eje soportado con cojinetes de balas de lubricación permanente, todos los cojines diseñados para un funcionamiento mínimo de 40,000 horas. El ventilador y el motor deberá ser soportada en estructura de acero, incluyendo una guardera protectora.

La distribución de agua interior será mediante sprinklers.
La torre deberá incluir uso escalera metálico por inyección y mantenimiento de motor y ventilador que se ubiquen en la parte superior del equipo.

Se incluirá sistema de ablandamiento adecuado para las torres de enfriamiento, además del tratamiento químico del agua para el funcionamiento inicial y la operación de 12 meses continuados tanto en el agua helada como en el agua de condensación.

2.3.2.6

Sistema de Control Inteligente a Instalar.-

Se proveerá además un sistema inteligente para el control y monitoreo de los siguientes equipos:

- Unidades centrales de enfriamiento de agua
- Electrobombas de agua helada
- Unidades manejadoras de aire
- Ventiladores
- Torres de enfriamiento
- Electrobombas de agua de condensación

Las características generales del sistema son:

HARDWARE:

Estación de Trabajo (PC):

Todas las estaciones mostradas en planos o indicados en las especificaciones, deben incluir la siguiente configuración como mínimo:

- Microprocesador Pentium 166 Mhz o mayor
- 32 MB de Memoria RAM
- 512 KB de Memoria Caché
- 2.1 GB de disco duro
- Monitor a color de 17" SVGA
- Lectora CD 12x
- Lectora de discos 3.5" (1.44 Mb)
- Dos puertos paralelos, dos puertos seriales y un puerto para mouse
- Mouse y Teclado
- Software Multitarea Windows NT
- Impresora de reportes y alarmas

El sistema propuesto podrá soportar múltiples estaciones de trabajo PC, todas conectadas entre ellas a través de una red LAN.

BUS de comunicaciones:

El bus de comunicaciones deberá ser un cable de tres conductores con aislamiento metálico para eliminación de ruidos. El protocolo de comunicaciones EIA Standard RS-485 deberá ser empleado u otro compatible.

SOFTWARE.

Software de Operación:

Se deberá proveer software de operación multitarea para todas las estaciones de trabajo, como se muestra en los documentos del contrato. Versiones para simple usuario deberán incluir software completo, incluyendo la base de datos.

La versión multiusuario trabajará como servidor, y todas las otras estaciones PC (locales y remotas) trabajarán como clientes instalados en una red local en comunicación con su servidor. Las estaciones remotas PC, serán conectadas al servidor vía marcador telefónico en la red.

CONTRASEÑAS:

El sistema propuesto será capaz de soportar un mínimo de 100 contraseñas para los operadores. Cada operador debe tener asignado un nivel de acceso. Cada nivel de acceso será personalizado para tener el acceso a las funciones de control requeridas del menú o a todas las funciones disponibles (p. Ejemplo sólo observador, capacidad para forzar puntos de ajuste, etc). Cada nivel de acceso del operador será demás personalizado en función a la asignación de restricciones de control para áreas distintas (acceso total en un edificio, sólo observador en otro, y programación personalizada en otro)

INTERFASE DEL OPERADOR:

Este será transparente la operador cuando la estación sea un cliente o un servidor (no aplicable a versión simple usuario). El sistema propuesto incluirá pantallas con formato estandard en Windows, comandos, convenciones de menú y ventanas de diálogo. El operador tendrá acceso a todas las órdenes de ayuda mostradas.

2.3.3 **DUCTOS.-**

Se fabricarán e instalarán de conformidad con los tamaños y recorridos mostrados en planos, la totalidad de los ductos metálicos para Aire Acondicionado.

El Contratista deberá verificar las dimensiones y comprobar que no existirán obstrucciones, proponiendo alteraciones en los casos necesarios y sin costo adicional, los que estarán sujetos a la aprobación del Ingeniero Supervisor.

Para la construcción de los ductos se emplearán planchas de fierro galvanizado de la mejor calidad, ARMCO tipo zinc- grip o similar.

En general, se seguirán las normas recomendadas por la Sociedad Americana de Ingenieros de Aire Acondicionado y Ventilación.

Para la ejecución de los ductos se seguirán las siguientes instrucciones:

Ancho del Ducto	Calibre	Empalmes y Refuerzos
Hasta 12"	N° 26	Correderas 1" a max. - 2.38 m. entre centros.
13" hasta 30"	N° 24	Correderas 1" a max. - 2.38 m. entre centros.
31" hasta 45"	N° 22	Correderas 1" a max. - 2.38 m. entre centros
46" hasta 60"	N° 20	Correderas 1.1/2" a max. - 2.38 m. entre centros.
Más de 61"	N° 20	Correderas 1.1/2" a max - 2.38 m. entre centros con refuerzo ángulo 1" x 1" x 1/8" entre empalmes.

Todos los ductos se asegurarán firmemente a techos a paredes. Los colgadores de ángulos de fierro negro de 1.1/4" x 1.1/4" x 1.1/8" con soportes de fierro negro de 3/8" Ø con rosca de 2".

Todos los colgadores y soportes se pintarán con pintura tipo galvánica en frio. La unión entre los ductos y los equipos se efectuarán por medio de juntas flexibles de lona de 8 onzas, de por lo menos 10 cms. de largo y asegurada con abrazaderas y empaquetaduras para cierre hermético.

Se proveerán compuertas manuales en los desvíos de los ductos empleando planchas de fierro galvanizado N° 20, cuyo eje irá apoyado en las caras del ducto con cojinetes de bronce. El eje identificará desde el exterior la posición real de la compuerta.

Los codos se construirán con el radio menor, igual a los 3/4" de la dimensión del ducto en la dirección del giro, donde por limitaciones de espacio no se pueden instalar codos curvos, se instalarán codos rectangulares con guías de doble espesor.

Las transformaciones se construirán con una pendiente hasta 25%
Los ductos de descarga de aire acondicionado se aislarán en todo su recorrido, con planchas de lana de vidrio de 1" de espesor forrado con foil de aluminio. Los pnmeros 8 mts. después de la descarga serán aislados interiormente tal como se muestra en planos.

2.3.4 DIFUSORES Y REJILLAS.-

Los difusores de techo serán fabricados en aluminio anodizado y de diseño similar al Tuttle & Bailey tipo ME "Multi-Patter" o equivalente aceptado, serán cuadrados o rectangulares con empaquetadura de jebe.

Los difusores de las áreas grandes serán del tipo lineal, según detalle mostrado en planos, similar al TUTTLE & BAILEY, con caja de distribución incluida en las dimensiones indicadas.

Las rejillas de retorno serán similares a los Tuttle & Bailey tipo T70D o equivalente aceptado. De acero pintados esmaltados al horno. Con empaquetaduras de jebe. Podrán ser similares de fabricación nacional.

Las rejillas de descarga serán de fabricación Tuttle & Bailey del tipo T64 o equivalente aprobada, con doble juego de barras direccionales. De acero pintado esmaltado al horno. Con empaquetadura de jebe. Podrán ser similares de fabricación nacional.

2.3.5 DAMPER.-

Los dampers serán de plancha galvanizada de 1 mm. de iguales características que los ductos a un eje de varilla de fierro galvanizado de 3/8", por medio de soldadura.

Poseerá un indicador de posición de platina de fierro negro de 3/4" x 1/8", por medio de soldadura.

Poseerá un indicador de posición de platina de fierro negro de 3/4" x 1/8" soldada al eje de una base también construida de platinas de fierro. Incorporará rodajes o cojinetes correctamente lubricados para el giro del eje.

Se incluirán sistemas para el ajuste del damper para su posición fija mediante tuerca en mariposa y sellos o empaquetaduras para evitar fugas.
Acabado de las partes de fierro expuestas serán con dos manos de pintura anticorrosiva y dos de acabado.

Las tuberías deberán ser suministradas con uniones simples roscadas y galvanizadas, según especificaciones indicadas.
Para el caso de tuberías de baja presión este será de cobre tipo "K" soldable.

Accesorios.-

Los accesorios, codos 90°, codos 45°, tees, cruz, etc., serán de fierro maleables, especificación ASTM A157 para la presión de trabajo de 150 lbs., con dimensiones y pesos especificados conforme a ASA B16c., con rosca interior en sus extremos.

Los accesorios deberán ser galvanizados, interior y exteriormente procesados en caliente, según especificaciones indicadas.

Válvulas de Bola.-

Serán del tipo "shut off" o bola. Con cuerpo, terminales de tuberías y vástago de bronce forjado. La bola será de bronce con recubrimiento de cromo. Especialmente limpiada para el servicio de gas propano. Provisto con sello de vástago de teflón y de neoprene para el cuerpo y fin.

Con asientos de Neoprene elástico.
Del tipo 3 piezas, o sea que la válvula pueda desarmarse sin necesidad de retirarla de la línea. Con indicador de posición abierta o cerrada.

Las uniones serán del tipo para roscar.
Para la presión de trabajo de 125 PSI para las de hasta 2" de diámetro y 300 PSI para las de 2.1/2" a 4" de diámetro.
Deberán tener grabado en el cuerpo la marca y presión de trabajo a 500 °F.

2.3.6 TUBERÍA DE DRENAJE.-

Se proveerá e instalará la tubería de drenaje de cada unidad evaporadora, las cuales deberán conectarse adecuadamente a la bandeja receptora de cada unidad hasta el sumidero existente.

Se debe instalar ésta línea de drenaje con tuberías de F.G. de 2"0,/ , cuidando que se respete la pendiente adecuada y las trampas de agua de drenaje y evitar atoros o inundaciones por éstas causas.

2.3.7 INSTALACIONES ELÉCTRICAS.-

El Proveedor de los equipos suministrará e instalará un tablero eléctrico de control para las unidades componentes del sistema.

El tablero será del tipo gabinete para adosar o empotrar a muros, con puerta y chapa e interruptores termomagnéticos del tipo SACE, MITSUBISHI o SQUARE D, de acuerdo a la demanda indicada en los planos de cada uno de los motores. Los tableros se conectarán en el punto de fuerza previsto por el Propietario.

El Proveedor suministrará además todos los materiales (tuberías, cables, conectores, etc.) requeridos para la conexión eléctrica de las unidades, incluyendo protectores térmicos contra sobrecargas y variaciones de tensión arrancadores, además elementos que aseguren el perfecto funcionamiento y protección de los motores del sistema.

Para todos los trabajos de instalación se seguirán fielmente las recomendaciones de la última edición vigente del Código Eléctrico Nacional y el Reglamento Nacional de Construcción.

ANEXO B

EJEMPLOS DE HOJAS DE SELECCIÓN COMPUTARIZADA

MS-85(R) AIR HANDLER SELECTION McQuay International
MCQUAY INTERNATIONAL VERSION 3.55

CUSTOMER NAME	JOB NAME	REP NAME & CITY	SALESMAN
TELEFONICA DEL PERU	EDIF. GRIMALDO D'SOLTERMO SISTEMAS S.A.		R.M.

SEQUENCE NUMBERS: 41 & 42 JOB ITEM: UM-2 SUN: 03/04/98

McQUAY MODEL NO.	F A N SIZE	TYPE	DESIGN (ACTUAL) ACFM	EXT. SP. (ACTUAL) INCHES WC	TOTAL SP INCHES WC	BRAKE HP	FAN RPM	OUTLET VEL FPM	ALTITUDE FT
LSL117	STD	FC	8670.	.00	3.18	7.10	974.	2064.	0.
LSL117	OPT	FC	8670.	.00	3.18	6.83	886.	1871.	0.

DRAW-THRU UNIT SINGLE ZONE

UNIT ARRANGEMENT - HORIZONTAL

DISCHARGE - UPBLAST

INTERNAL AIR PRESSURE DROPS:

COOLING COIL	1.00
FLAT FILTER SECTION WITH CLEANABLE FILTERS	.18
SUM OF INTERNAL STATIC PRESSURE DROP	1.18

REFER TO AIR HANDLER UNIT CATALOG FOR MAXIMUM COIL DEPTH
OF COIL SECTIONS (IN THE DIRECTION OF AIRFLOW).

TOTAL SOUND POWER LEVELS AS CALCULATED BY ASHRAE METHOD(REF.10EXP-12 WATTS)

OCTAVE BANDS	1	2	3	4	5	6	7	dB A
TOTAL PWL	96	92	88	82	79	74	72	85
TOTAL PWL	96	92	88	82	79	74	72	85

TO OBTAIN RADIATED SOUND POWER AS CALCULATED BY ASHRAE.
SUBTRACT 15 dB FROM EACH OCTAVE BAND AND FROM dB A.

MS-85(R) COOLING COIL SELECTIONS McQuay International
MCQUAY INTERNATIONAL

CUSTOMER NAME: TELEFONICA DEL PERU
JOB NAME: EDIF. GRIMALDO D'SOLTERMO SISTEMAS S.A.
REP NAME & CITY:
SALESMAN: R.M.

SEQUENCE NUMBER: 41 JOB ITEM: UM-2 RUN: 03/04/98

<-- AIR HANDLER -->				<---------- COIL DIMENSIONS ---------->					<---- MISC ---->		
MX FV FPM	AHU SIZE	SECT SIZE	#	TYPE	FH IN	FL IN	<-SPECIFIED-> FIN ROW SRP	FA FT^2	GLY %	WPD FT	ALTI FT
550.	117	LA	1	W	30.0	80.5		16.77	0		0

<------- ENTERING CONDITIONS ------>					<--------- LEAVING CONDITIONS --------->				
A-FLOW ACFM	EDB F	EWB F	EWT F	FLOW GPM	LDB F	LWB F	TOTAL BTUH	SENSIBLE BTUH	LWT F
8670.	74.1	63.0	44.0	61.9			300000.	191000.	

MS-85(R) OUTPUT DATA ARI CERTIFIED VERSION = 3.55

SEL	COIL MODEL	TOTAL BTUH	SENSIBLE BTUH	FV FPM	LDB F	LWB F	W-FLOW GPM	LWT F	WV FPS	WPD F-H20	APD I-H20	CONN NPT
Most ECONOMICAL												
1	5WL12050	300000.	219052.	517	51.0	50.8	61.9	53.8	4.4	10.5	1.00	3.00

STANDARD FIN AND STANDARD TUBE.

MS-85(R) AIR HANDLER SELECTION McQuay International
MCQUAY INTERNATIONAL VERSION 3.55

CUSTOMER NAME: TELEFONICA DEL PERU
JOB NAME: EDIF.GRIMALDO D'SOL
REP NAME & CITY: TERMO SISTEMAS S.A.
SALESMAN: R.M.

SEQUENCE NUMBERS: 45 & 46 JOB ITEM: UM-T RUN: 06/04/98

McQUAY MODEL NO.	F a N SIZE	TYPE	DESIGN (ACTUAL) ACFM	EXT. SP. (ACTUAL) INCHES WC	TOTAL SP INCHES WC	BRAKE HP	FAN RPM	OUTLET VEL FPM	ALTITUDE FT
LSL117	STD	FC	8460.	2.00	3.58	7.62	1031.	2014.	0.
LSL117	OPT	FC	8460.	2.00	3.58	7.46	940.	1630.	0.

DRAW-THRU UNIT SINGLE ZONE

UNIT ARRANGEMENT - HORIZONTAL

DISCHARGE - UPBLAST

- -

INTERNAL AIR PRESSURE DROPS:

- -

COOLING COIL	1.41
FLAT FILTER SECTION WITH CLEANABLE FILTERS	.17
SUM OF INTERNAL STATIC PRESSURE DROP	1.58

REFER TO AIR HANDLER UNIT CATALOG FOR MAXIMUM COIL DEPTH
OF COIL SECTIONS (IN THE DIRECTION OF AIRFLOW).

- -

TOTAL SOUND POWER LEVELS AS CALCULATED BY ASHRAE METHOD(REF.10EXP-12 WATTS)

OCTAVE BANDS	1	2	3	4	5	6	7	dB A
TOTAL PWL	97	93	89	83	80	75	73	86
TOTAL PWL	97	93	89	83	80	75	73	86

TO OBTAIN RADIATED SOUND POWER AS CALCULATED BY ASHRAE.
SUBTRACT 15 dB FROM EACH OCTAVE BAND AND FROM dB A.

MS-85(R) COOLING COIL SELECTIONS McQuay International

MCQUAY-INTERNATIONAL

CUSTOMER NAME	JOB NAME	REP NAME & CITY	SALESMAN
TELEFONICA DEL PERU	EDIF.CRIMALDO D'SOL TERMO SISTEMAS S.A.		R.M.

SEQUENCE NUMBER: 45 JOB ITEM: UM-T RUN: 06/04/98

<-- AIR HANDLER -->			<---------- COIL DIMENSIONS ---------->					<---- MISC ---->		
MX FV FPM	AHU SIZE	SECT SIZE	#	TYPE	FH IN	FL IN	<-SPECIFIED-> FIN ROW	SRF	FA FT^2	GLY %	WPD FT	ALTI FT
550.	117	LA	1	W	30.0	80.5			16.77	0		0

<---------- ENTERING CONDITIONS ------>				<--------- LEAVING CONDITIONS --------->				
A-FLOW ACFM	EDB F	EWB F	EWT F	FLOW GPM	LDB F	LWB F	TOTAL BTUH	SENSIBLE BTUH	LWT F
8460.	74.1	63.0	44.0	67.9			339500.	213800.	

MS-85(R) OUTPUT DATA ARI CERTIFIED VERSION = 3.55

SEL	COIL MODEL	TOTAL BTUH	SENSIBLE BTUH	FV FPM	LDB F	LWB F	W-FLOW GPM	LWT F	WV FPS	WPD F-H2O	APD I-H2O	CONN NPT
ECONOMICAL												
1	5WL10080	346334.	236332.	504	48.5	48.3	67.9	54.0	4.9	19.2	1.41	2.00

STANDARD FIN AND STANDARD TUBE.

MS-85(R) AIR HANDLER SELECTION McQuay International
MCQUAY INTERNATIONAL VERSION 3.55

CUSTOMER NAME: TELEFONICA DEL PERU
JOB NAME: EDIF.GRIMALDO D'SOL TERMO SISTEMAS S.A.
REP NAME & CITY:
SALESMAN: R.M.

SEQUENCE NUMBERS: 43 & 44 JOB ITEM: UM-CI RUN: 06/04/98

McQUAY MODEL NO.	F A N SIZE	TYPE	DESIGN (ACTUAL) ACFM	EXT. SP. (ACTUAL) INCHES WC	TOTAL SP INCHES WC	BRAKE HP	FAN RPM	OUTLET VEL FPM	ALTITUDE FT
LSL122	STD	FC	10990.	2.00	3.38	9.65	918.	2118.	0.
LSL122	OPT	FC	10990.	2.00	3.38	9.19	821.	1747.	0.

DRAW-THRU UNIT SINGLE ZONE

UNIT ARRANGEMENT - HORIZONTAL

FAN DISCHARGE - UPBLAST

INTERNAL AIR PRESSURE DROPS:

COOLING COIL	1.21
FLAT FILTER SECTION WITH CLEANABLE FILTERS	.17
SUM OF INTERNAL STATIC PRESSURE DROP	1.38

REFER TO AIR HANDLER UNIT CATALOG FOR MAXIMUM COIL DEPTH OF COIL SECTIONS (IN THE DIRECTION OF AIRFLOW).

TOTAL SOUND POWER LEVELS AS CALCULATED BY ASHRAE METHOD(REF.10EXP-12 WATTS)

OCTAVE BANDS	1	2	3	4	5	6	7	dB A
TOTAL PWL	98	94	90	84	81	76	74	87
TOTAL PWL	98	94	90	84	81	76	74	87

TO OBTAIN RADIATED SOUND POWER AS CALCULATED BY ASHRAE,
SUBTRACT 15 dB FROM EACH OCTAVE BAND AND FROM dB A.

MS-85(R) COOLING COIL SELECTIONS McQuay International
MCQUAY INTERNATIONAL

CUSTOMER NAME | JOB NAME | REP NAME & CITY | SALESMAN
TELEFONICA DEL PERU | EDIF.GRIMALDO D'SOL TERMO SISTEMAS S.A. | R.M.

SEQUENCE NUMBER: 43 JOB ITEM: UM-CI RUN: 06/04/98

<-- AIR HANDLER -->			<---------- COIL DIMENSIONS ---------->						<---- MISC ---->		
MX FV FPM	AHU SIZE	SECT SIZE	#	TYPE	FH IN	FL IN	<-SPECIFIED-> FIN	ROW	SRF	FA FT^2	GLY %	WPD FT	ALTI FT
550.	122	LA	1	W	36.0	84.5				21.13	0		0

<------- ENTERING CONDITIONS ------>					<--------- LEAVING CONDITIONS --------->				
A-FLOW ACFM	EDB F	EWB F	EWT F	FLOW GPM	LDB F	LWB F	TOTAL BTUH	SENSIBLE BTUH	LWT F
10990.	74.1	63.0	44.9	82.7			413400.	257650.	

MS-85(R) OUTPUT DATA ARI CERTIFIED VERSION = 3.55

SEL	COIL MODEL	TOTAL BTUH	SENSIBLE BTUH	FV FPM	LDB F	LWB F	W-FLOW GPM	LWT F	WV FPS	WPD F-H2O	APD I-H2O	CONN NPT
	ECONOMICAL											
1	5WL1206C	413916.	293243.	520	49.7	49.5	82.7	54.1	4.9	15.0	1.21	2.50

STANDARD FIN AND STANDARD TUBE.

Submittal Data Information

FE Series Pumps

301-828T

MODEL 2513 — **1760 RPM**

JOB: Grimaldo

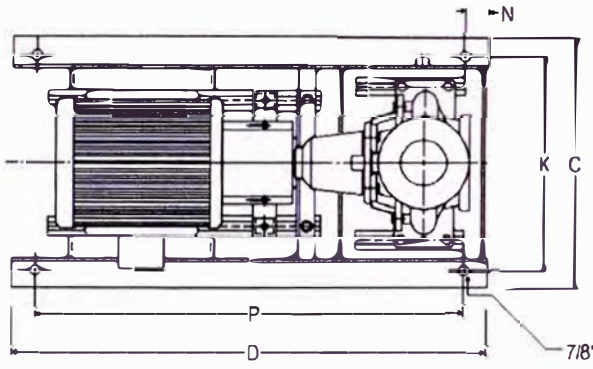
CONTRACTOR: TermoSistemas

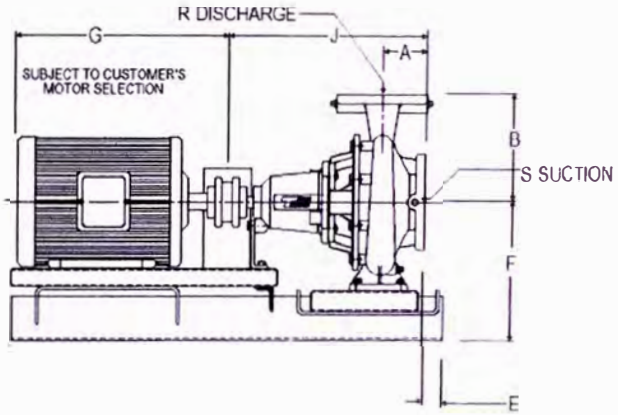
ENGINEER:

REP:

COMMENTS:

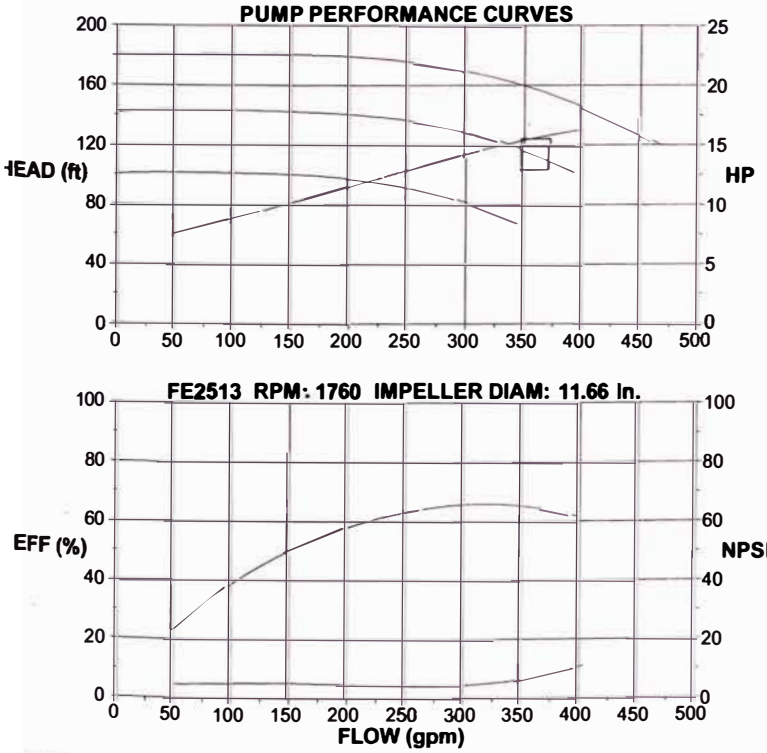
ITEM NO.	MODEL NO.	IMP. DIAM. / IN.	FLOW / GPM	HEAD / FT	POWER / HP	ELEC. CHARS
BAHS	FE2513	11.7	360	114	20	1760/60





* Dimensions in inches.

HP	FRAME	A	B	C	D	E	F	J	K	N	P	R	S
20	256T	4-23/32	10-27/32	22	49	1-1/2	12-3/8	22-5/16	20	2	45	2-1/2	3



Item	BRONZE FITTED		ALL IRON	
	Std. Pump Constr.	Optional	Standard	Optional
Casing	Cast Iron ASTM A48 Cl.35		Cast Iron ASTM A48 Cl.35	
Impeller	Bronze ASTM B30-4A		Cast Iron ASTM A48 Cl.35	
Wear Ring	Bronze ASTM B30-4A		Bronze ASTM B30-4A	
Shaft	Carbon Steel AISI 1045	St. Steel AISI 416	Carbon Steel AISI 1045	St. Steel AISI 416
Shaft Sleeve	Bronze SAE 660	St. Steel AISI 416	St. Steel AISI 416	
Mech. Seal	Ceramic	Tungsten Carbide	Ceramic	Tungsten Carbide
Seal Flush Line		Copper		Copper

OPERATING SPECIFICATIONS	Standard	Optional
Pressure	175 PSIG*	
Temperature: Mechanical Seal	250F	300F

Motors: All NEMA Standard (T or TS)
* In Accordance with ANSI Standard B16.1 Class 125

ADDITIONAL OPTIONS	
Filters	Cuno 5 Micron
Separators	Kynar Cyclone Separator
Couplings	Spacer Type

COMPARE. YOU'LL TAKE TACO.

TACO, INC., 1160 Cranston Street, Cranston, RI 02920 Telephone: (401)942-8000 FAX: (401)942-2360.
TACO (Canada), Ltd., 6180 Ordan Drive, Mississauga, Ontario L5T 2B3. Telephone:905/564-9422. FAX: 905/564-9436

Submittal Data Information

FE Series Pumps

301-830T

MODEL 3008

1760 RPM

JOB: Grimaldo

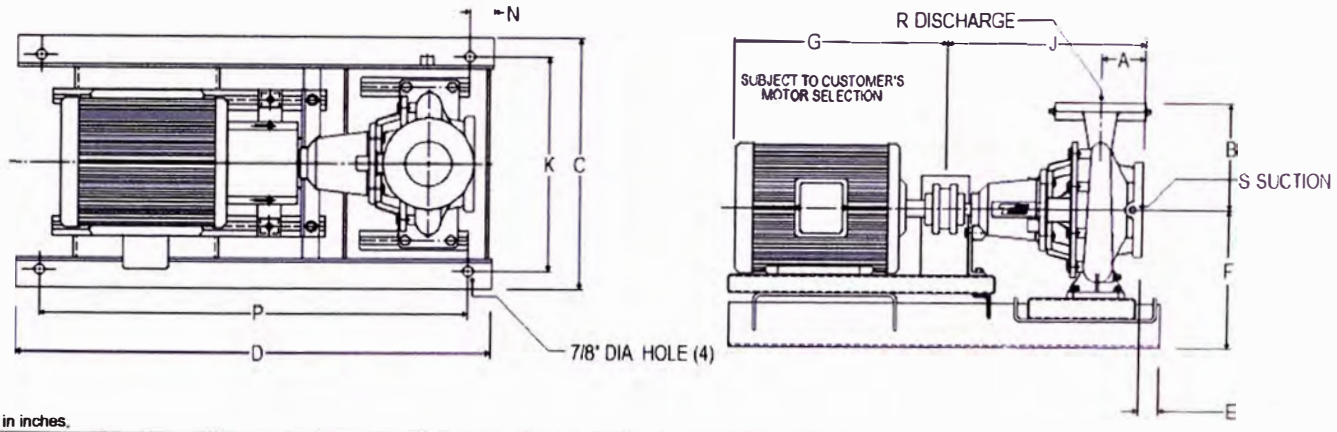
CONTRACTOR: TermoSistemas

ENGINEER:

REP:

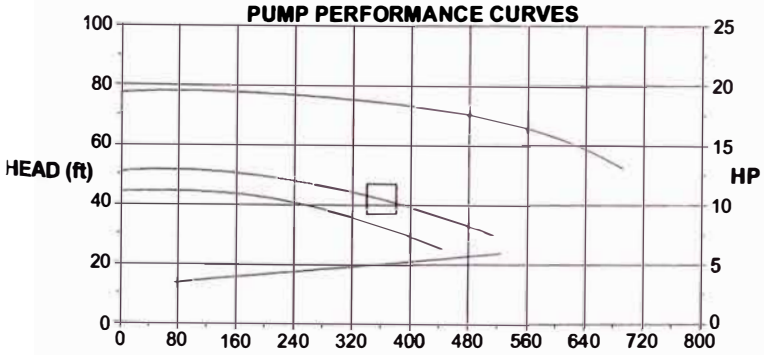
COMMENTS:

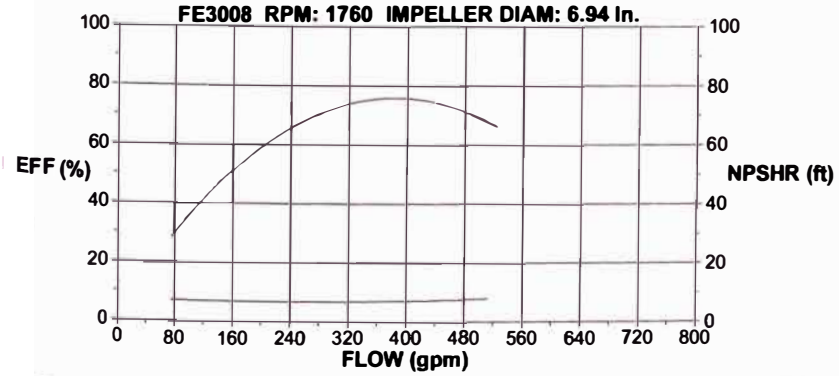
ITEM NO.	MODEL NO.	IMP. DIAM. / IN.	FLOW / GPM	HEAD / FT	POWER / HP	ELEC. CHARS
BAHP	FE3008	6.9	360	42	7.5	1760/60



* Dimensions in inches.

HP	FRAME	A	B	C	D	E	F	J	K	N	P	R	S
7.5	213T	4-23/32	9-5/8	20	46	1-1/2	10-19/32	21-5/16	18	2	42	3	4





Item	BRONZE FITTED		ALL IRON	
	Std. Pump Constr.	Optional	Standard	Optional
Casing	Cast Iron ASTM A48 Cl.35		Cast Iron ASTM A48 Cl.35	
Impeller	Bronze ASTM B30-4A		Cast Iron ASTM A48 Cl.35	
Wear Ring	Bronze ASTM B30-4A		Bronze ASTM B30-4A	
Shaft	Carbon Steel AISI 1045	St. Steel AISI 416	Carbon Steel AISI 1045	St. Steel AISI 416
Shaft Sleeve	Bronze SAE 660	St. Steel AISI 416	St. Steel AISI 416	
Mech. Seal	Ceramic	Tungsten Carbide	Ceramic	Tungsten Carbide
Seal Flush Line		Copper		Copper

OPERATING SPECIFICATIONS	Standard	Optional
Pressure	175 PSIG*	
Temperature: Mechanical Seal	250F	300F

Motors: All NEMA Standard (T or TS)
* In Accordance with ANSI Standard B16.1 Class 125

ADDITIONAL OPTIONS	
Filters	Cuno 5 Micron
Separators	Kynar Cyclone Separator
Couplings	Spacer Type

COMPARE. YOU'LL TAKE TACO.

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TACO (Canada), Ltd., 6180 Ordan Drive, Mississauga, Ontario L5T 2B3. Telephone:905/564-9422. FAX: 905/564-9436

Submittal Data Information

FE Series Pumps

301-832T

MODEL 3013 **1760 RPM**

JOB: Grimaldo

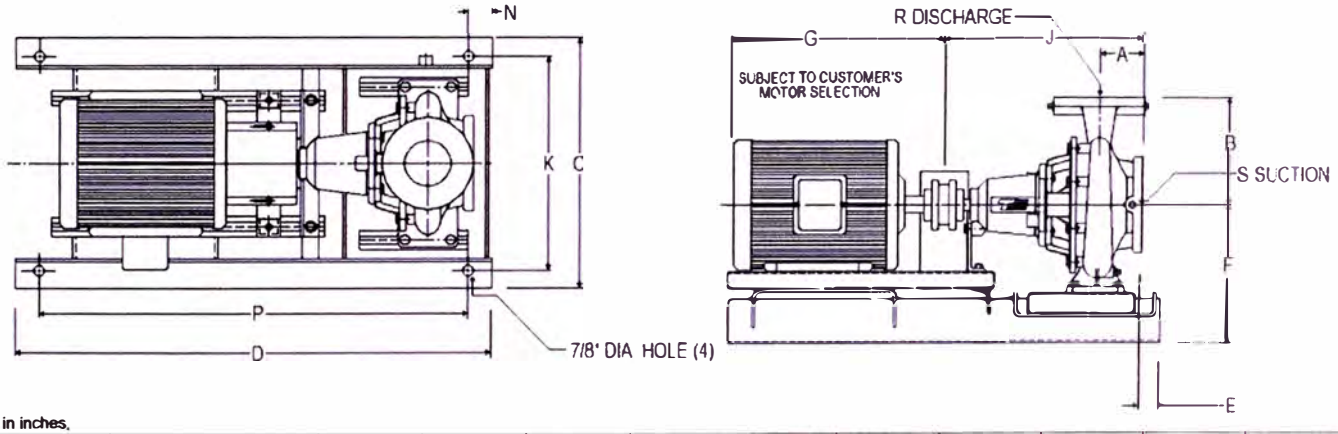
CONTRACTOR: TermoSistemas

ENGINEER:

REP:

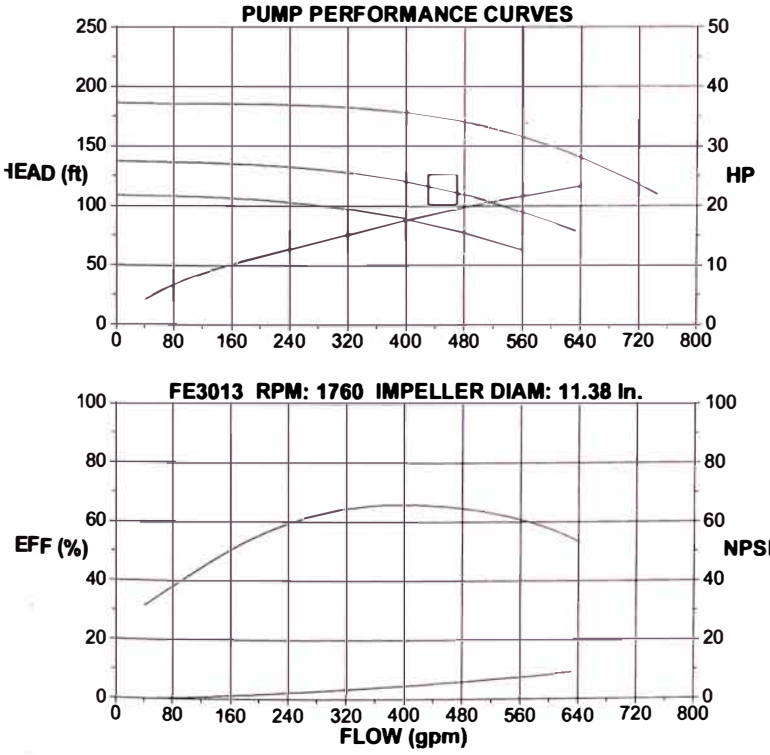
COMMENTS:

ITEM NO.	MODEL NO.	IMP. DIAM. / IN.	FLOW / GPM	HEAD / FT	POWER / HP	ELEC. CHARS
	FE3013	11.4	450	114	20	1760/60



* Dimensions in inches.

HP	FRAME	A	B	C	D	E	F	J	K	N	P	R	S
20	256T	4-23/32	12-7/32	22	53	1-1/2	13-11/32	22-5/16	20	2	49	3	4



Item	BRONZE FITTED		ALL IRON	
	Std. Pump Constr.	Optional	Standard	Optional
Casing	Cast Iron ASTM A48 Cl.35		Cast Iron ASTM A48 Cl.35	
Impeller	Bronze ASTM B30-4A		Cast Iron ASTM A48 Cl.35	
Wear Ring	Bronze ASTM B30-4A		Bronze ASTM B30-4A	
Shaft	Carbon Steel AISI 1045	St. Steel AISI 416	Carbon Steel AISI 1045	St. Steel AISI 416
Shaft Sleeve	Bronze SAE 660	St. Steel AISI 416	St. Steel AISI 416	
Mech. Seal	Ceramic	Tungsten Carbide	Ceramic	Tungsten Carbide
Seal Flush Line		Copper		Copper

OPERATING SPECIFICATIONS	Standard	Optional
Pressure	175 PSIG*	
Temperature: Mechanical Seal	250F	300F

Motors: All NEMA Standard (T or TS)
* In Accordance with ANSI Standard B16.1 Class 125

ADDITIONAL OPTIONS	
Filters	Cuno 5 Micron
Separators	Kynar Cyclone Separator
Couplings	Spacer Type

COMPARE. YOU'LL TAKE TACO.

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TACO (Canada), Ltd., 6180 Ordan Drive, Mississauga, Ontario L5T 2B3. Telephone:905/564-9422. FAX: 905/564-9436

Penn Ventilation Equipment Schedule

Job Name: Gimaldo

Job Notes:

Tag Number: EA-01

Fan Notes:

QTY	Model	CFM	RPM	HP	Drive	Inlet - SF/FPM	SE%	Altitude	Ship Wt.
1	Breezeway P	282	1550	1/12	Direct	0.630 448	0.00	0	107. lbs.
	P10RA	**SP**	**TS**	**BHP**	**Opng"**	**Outlet - SF/FPM**	**ME%**	**Temp.**	**Dmpr.O.D.**
		0.398	4057	123.000	15.75	0.545 517	0.00	70	15.5 in.

Motor: 1/12 HP 115/1/60 Open **Sones:** 13.1 **NC:** 65 **DBA:** 62

Accessories:

Tag Number: EC-01

Fan Notes:

QTY	Model	CFM	RPM	HP	Drive	Inlet - SF/FPM	SE%	Altitude	Ship Wt.
1	Zephyr ZC	350	526	1/4	Belt	2.531 138	44.32	0	107. lbs.
	ZC10	**SP**	**TS**	**BHP**	**Opng"**	**Outlet - SF/FPM**	**ME%**	**Temp.**	**Dmpr.O.D.**
		0.3	1377	.000	0.00	1.038 337	45.36	70	-.25 in.

Motor: 1/4 HP 115/1/60 Open **Sones:** 7.4 **NC:** 50 **DBA:** 54

Accessories:

Tag Number: EC-02

Fan Notes:

QTY	Model	CFM	RPM	HP	Drive	Inlet - SF/FPM	SE%	Altitude	Ship Wt.
1	Zephyr ZC	1000	628	1/4	Belt	2.531 395	41.38	0	107. lbs.
	ZC10	**SP**	**TS**	**BHP**	**Opng"**	**Outlet - SF/FPM**	**ME%**	**Temp.**	**Dmpr.O.D.**
		0.35	1644	.100	0.00	1.038 963	48.22	70	-.25 in.

Motor: 1/4 HP 115/1/60 Open **Sones:** 9.2 **NC:** 55 **DBA:** 57

Accessories:

Tag Number: IC-01

Fan Notes:

QTY	Model	CFM	RPM	HP	Drive	Inlet - SF/FPM	SE%	Altitude	Ship Wt.
1	Zephyr ZC	1210	689	1/4	Belt	2.531 478	38.51	0	107. lbs.
	ZC10	**SP**	**TS**	**BHP**	**Opng"**	**Outlet - SF/FPM**	**ME%**	**Temp.**	**Dmpr.O.D.**
		0.4	1803	.200	0.00	1.038 1166	46.66	70	-.25 in.

Motor: 1/4 HP 115/1/60 Open **Sones:** 10.3 **NC:** 55 **DBA:** 59

Accessories:

Penn Ventilation Equipment Schedule

Job Name: Gimaldo

Job Notes:

AMCA License Statements

Tag Number:	Model	
EA-01	Breezeway P	P10RA

Penn Ventilation certifies that the model shown is licensed to bear the AMCA seal. The ratings shown are based on tests and procedures performed in accordance with AMCA publication 211 and AMCA publication 311 and comply with the requirements of the AMCA Certified Ratings Program.

Performance shown is for installation type A - Free inlet, Free outlet. Speed (RPM) shown is nominal. Performance shown is based on actual speed of test. Performance ratings include the effects of bird screen or backguard in the airstream. The sound ratings shown are loudness values in fan sones at 5 ft. (1.5 m) in a hemispherical free field calculated per AMCA Standard 301. Values shown are for Installation Type A: free inlet fan sone levels. The sound power

Standard 301. The AMCA certified ratings program applies to sones and full octave band sound power levels only.

Tag Number:	Model	
EC-01	Zephyr ZC	ZC10
EC-02	Zephyr ZC	ZC10
IC-01	Zephyr ZC	ZC10

Penn Ventilation certifies that the model shown is licensed to bear the AMCA seal. The ratings shown are based on tests and procedures performed in accordance with AMCA publication 211 and comply with the requirements of the AMCA Certified Ratings Program.

rating (BHP) includes drive losses. Performance ratings do not include the effects of appurtenances in the airstream. The sound ratings shown are loudness values in fan sones at 5 ft. (1.5 m) in a hemispherical free field calculated per AMCA Standard 301. Values shown are for Installation Type B:

referred to 10-12 watts calculated per AMCA Standard 301. The AMCA Certified

program applies to sones and full octave band sound power levels only.

ANEXO C

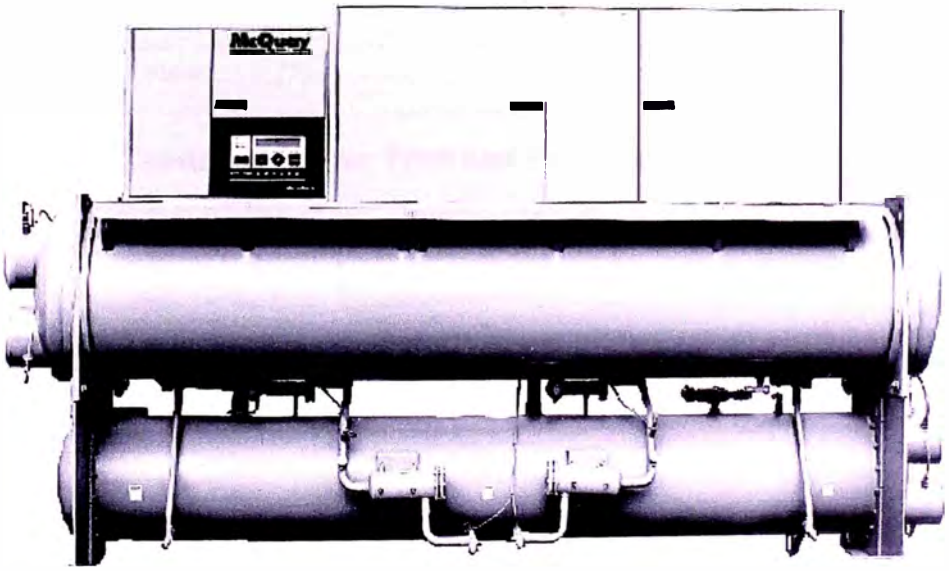
HOJAS TÉCNICAS DE SENSORES Y DISPOSITIVOS DEL SISTEMA DE CONTROL INTELIGENTE Y EQUIPAMIENTO MECÁNICO

Installation Manual

IM 692-1
Group: **Chiller**
Part Number: **629955**
Effective: **May 1997**
Supersedes: **IM663-1** **IM683** **IM692**

Water-Cooled Dual Compressor Screw Chiller

Installation Manual
PFS 155C through PFS 210C, R-22
PFS 235C through PFS 315C, R-410A
60 Hertz



McQuay Air Conditioning

Table of Contents

Introduction

McQuay StarGate™ water-cooled chillers are completely assembled, factory wired, evacuated, charged, tested and ready for installation. Each unit consists of a water-cooled condenser with integral subcooler, twin accessible semi-hermetic single screw compressors, replaceable tube shell-and-tube evaporator, and complete refrigerant piping. Liquid line components included are manual liquid line shutoff valves, charging valves, filter-dryers, liquid line solenoid valves, sightglass/moisture indicators, and electronic expansion valves. Other features include compressor heaters, and an advanced fully integrated microprocessor control system.

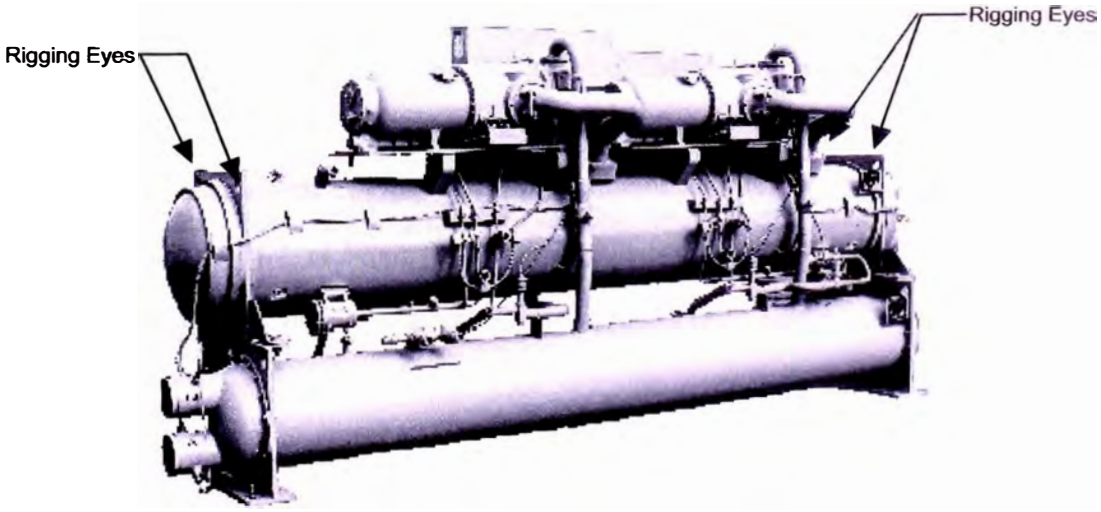
The electrical control center includes all safety and operating controls necessary for dependable automatic operation, (the high and low pressure controls are external from the electrical control center). Compressors are protected by solid-state overload protection and over temperature protection. Field installed fused disconnect switch (furnished by others) offers additional protection.

Receiving and Handling

Inspect the unit immediately after receipt for possible damage. The unit is shipped FOB factory and all claims for handling and shipping damage are the responsibility of the consignee. Leave the shipping skid in place until the unit is in final position. This will aid in handling the equipment. Use extreme care when rigging the equipment to prevent damage to the control center, or refrigerant piping. See Dimensional Data for the center of gravity of the unit.

Lift the unit by fastening the rigging hooks to the four corners of the evaporator where the rigging eyes are located (see Figure 1). Use spreader bars between the rigging lines to prevent damage to the control center.

Figure 1, Rigging Eyes



Installation

CAUTION

Installation must be performed by qualified personnel who are familiar with local codes, regulations, and experienced with this type of equipment

Start-up by McQuayService is included on all units sold for installation within North America excluding Mexico. Two weeks prior notification of start-up is required. The contractor should obtain a copy of the Start-up Scheduled Request Form from the sales representative or from the nearest McQuayService office.

Location and Mounting

Mount the unit on level concrete or steel base. Service clearance (at either end of the unit) is 12 feet for units with 10 feet long shells, 14 feet for units with 12-feet long shells and 16 feet for units with 14 feet long shells. Evaporator and condenser tubes are rolled into the tube sheets to permit replacement. Clearance at all other points, including the top, is 3 feet.

Make certain the floor or structural support is adequate to support the full operating weight of the complete unit. Optional rubber-in-shear pads, or spring isolators can be ordered for use under each corner of the base members. It is not necessary to bolt the unit to the mounting slab or frame work; although mounting holes are provided in the unit support at the four corners.

Compressor Condensation

Condensation occurs on the compressor surface when the temperature of the compressor surface is lower than the ambient dew point temperature. Drain pans with drain connections are provided underneath each compressor to collect the condensate. The compressor motor housing extends past the drain pans. Install a floor drain close to the unit to collect condensate from motor housing and condensate pans.

Vibration Isolators

Optional vibration isolator pads are shipped with the unit for field installation. These pads provide minimal isolation. Vibration isolators are recommended on all upper level installations where vibration transmission is a consideration. When vibration isolators are used, install springs under the main unit supports. Adjust spring so the upper housing clears lower housing by at least 1/4" (6mm) and not more than 1/2" (1 3mm). If hold-down bolts are not used, install a rubber anti-skid under isolators. Install vibration eliminators in water piping to reduce piping strain, vibration, and noise. Table 1 lists spring and rubber-in-shear isolators for all PFS unit sizes.

Table 1, Vibration Isolators (PFS150B - 215B)

Isolator	Isolator Per Location			
	1	2	3	4
Rubber-in-Shear	RP-4	RP-4	RP-4	RP-4
Spring	CP-4-28	CP-4-28	CP-4-28	CP-4-28

Figure 2, Isolator location

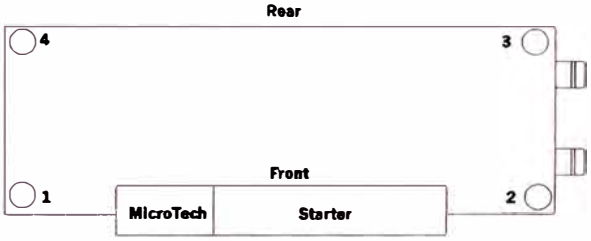


Table 2, Isolators (PFS150B - 215B)

Isolator	Type	Color Of Stripe	McQuay Part No.	Recom. Max Ld Lb. (Kg)
Rubber-In-Shear	RP-4	Green	0021639803	3300 (1497)
Spring	CP-4-28	Green	0058051328	3600 (1633)

Note: The spring is fully compressed at about 5400 lb (2449 Kg).

Figure 3 and Figure 4 give dimensions required to secure each McQuay isolator section to the mounting surface. The maximum loads for each unit are shown in Table 3.

Figure 3 , Rubber-in-Shear Isolator

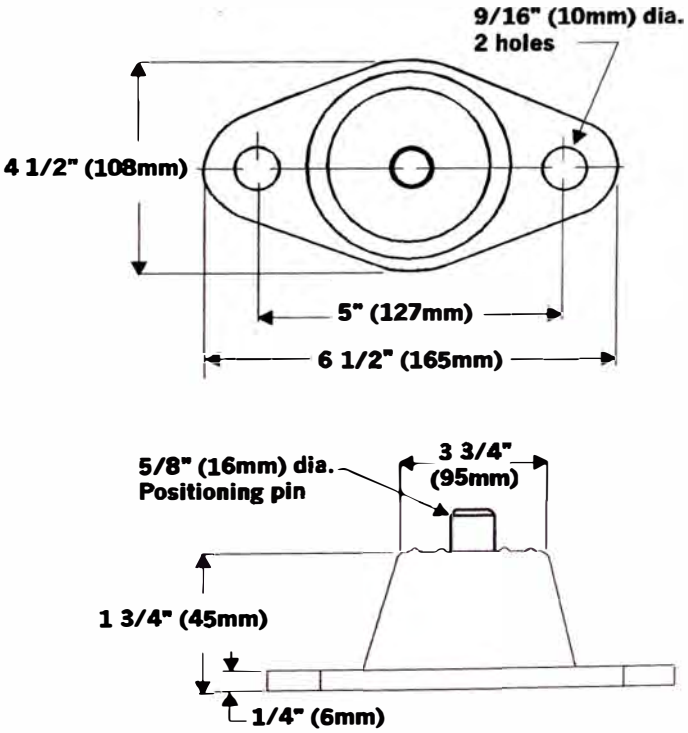


Figure 4,Spring Flex Isolator

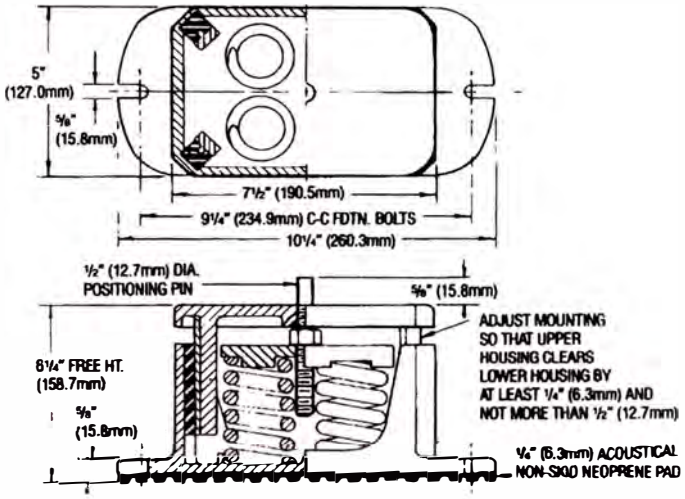
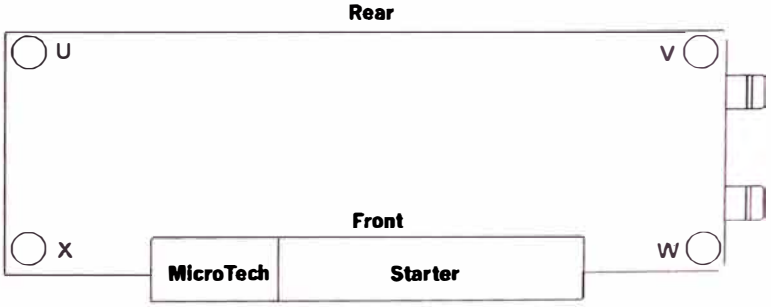


Table 3, Weights for Standard Shell Units

Unit	U	X	V	W
155-210 Short Shell	2007	2412	2213	2660
235-315 Short Shell	2292	2841	2498	3095
155-210 Standard Shell	2105	2475	2477	2913
235-315 Standard Shell	2564	3060	2935	3501
155-190 Long Shell	3236	3107	3819	3667
200,210 Long Shell	2988	3182	3339	3556
235-315 Long Shell	3153	3468	3480	3827

Figure 5, Corner Weight Locations



Evaporator and Condenser Water Piping

PFS evaporators and condensers are equipped with either victaulic or flange connections. The installing contractor must provide matching connections.

CAUTION

Remove the solid-state temperature sensor and thermostat bulbs from the wells to prevent damage to those components when welding on the victaulic or flange connections.

Connect the condenser with the inlet water entering at the bottom to maximize subcooling. The condenser water will discharge from the top connection.

Support piping to reduce weight and strain on the fittings and connections. Be sure piping is adequately insulated. Install a cleanable 20-mesh water strainer in evaporator and condenser water piping. Install enough shutoff valves to permit draining water from the evaporator or condenser without draining the complete system.

CAUTION

Freeze Notice: The evaporator and condenser are not self-draining. Both must be blown out.

Include thermometers at the inlet and outlet connections and air vents at the high points of piping. The water heads can be interchanged (end for end) allowing water connections to be made at either end of the unit. Use new head gaskets when interchanging water heads. When water pump noise is objectionable, use rubber isolation sections at both the inlet and outlet of the pump. Vibration eliminator sections in the condenser inlet and outlet water lines are not normally required. Where noise and vibration are critical, and unit is mounted on spring isolators, flexible piping connections are necessary.

Water treatment

If unit is operating with a cooling tower, clean and flush cooling tower. Make sure tower "blowdown" or bleedoff is operating. Atmospheric air contains many contaminants which increases the need for water treatment. The use of untreated water may result in corrosion, erosion, sliming, scaling, or algae formation. A water treatment service is recommended. McQuay International is not responsible for damage or faulty operation from untreated or improperly treated water.

Head pressure control, tower system

The minimum entering water temperature to the condenser must not be lower than 70°F (21.1°C) at full tower water flow. If lower temperature water is used, the flow must be reduced proportionally. Use a three-way bypass valve around the tower to modulate the condenser water flow. Figure 6 shows a three-way pressure actuator water regulating valve used for cooling applications. This regulating valve will assure an adequate condensing pressure if the inlet condenser water temperature falls below 70°F). An optional AOX-4 board located in the MicroTech panel will control a cooling tower bypass valve or a varible speed condenser pump.

Head Pressure Control, Well Water System

When using city or well water for condensing refrigerant, install a normally closed direct acting water regulating valve in the outlet piping of the condenser. This regulating valve will assure an adequate condensing pressure if the inlet condenser water temperature falls below 70°F. The condenser service valve provides a pressure tap for the regulating valve. The valve can modulate in response to head pressure. On shutdown, the valve closes, preventing water from siphoning out of the condenser. Siphoning causes condenser waterside drying and accelerates fouling. If a valve is not used, Figure 7 illustrates the recommendation of a loop at the outlet. Size the loop height (H) to offset the negative pressure caused by the siphoning effect. A vacuum breaker may be required.

Figure 6, Bypass valve

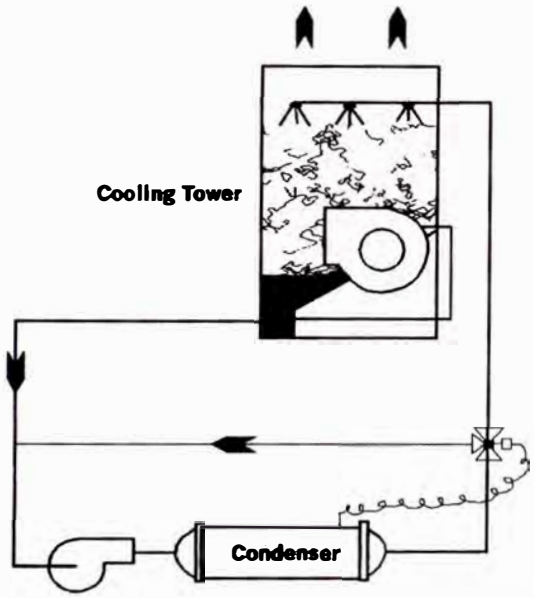
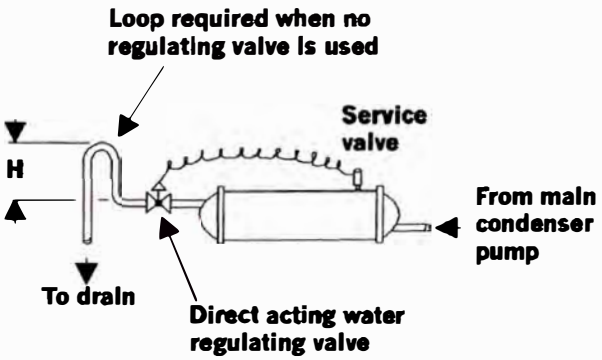


Figure 7, Well Water System



Relief Valve Piping

Follow the requirements of ANSI/ASHRAE Standard 15-1994 for relief valve piping. The condenser relief valve assembly consists of a tree valve and two relief valves. The tree valve must be fully front or back seated to ensure only one relief valve is available for discharge.

Temperature and Water Flow Limitations

PFS units are designed to operate in conditions from 20°F (-6.7°C) to 50°F (10°C) leaving water temperature on the evaporator side and 70°F (21.1°C) to 95°F (35°C) entering water temperature on the condenser side.

Glycol in the evaporator is required on all applications below 40°F (4.4°C) leaving evaporator fluid temperature. The maximum allowable water temperature to the cooler in a non-operating cycle is 105°F (40.6°C). The non-operating leaving condenser water temperature maximum is 115°F (46.1°C). Flow rates below the minimum values shown in the evaporator and condenser pressure drop curves may cause freeze-up problems, scaling and poor control. Flow rates above the maximum values shown in the evaporator and condenser pressure drop curves will result in unacceptable pressure drops, excessive nozzle and tube erosion and possibly cause tube failure.

Evaporator Freeze Protection

When freeze protection is a concern, do the following:

1. If the unit will not be operated during the winter, drain and flush the evaporator and chilled water piping with glycol . Drain and vent connections are provided on the evaporator.
2. When using a cooling tower, add glycol solution to the chilled water system. Freeze point should be approximately 10°F (5.6°C) below minimum design ambient temperature.

Note: Freeze damage is not considered a warranty failure and is not the responsibility of McQuay International.

3. Insulate field water piping, especially on the chilled water side.

Condenser Protection and Design Considerations

If pond or river water is used as a condensing medium and the water valves leak, the condenser and liquid line refrigerant temperature could drop below the equipment room temperature on the "off" cycle. This problem occurs when cold water continues to circulate through the condenser and the unit remains off due to satisfied cooling load. If this occurs:

1. Cycle the condenser pump off with the unit.
2. Verify the liquid line solenoid valves are operating properly.

Chilled Water Thermostat

The PFS water-cooled chiller is equipped with the MicroTech leaving water controller. Be careful when working around the unit to avoid damaging lead wires and sensor cables. Check lead wires before running the unit. Avoid rubbing the lead wires on the frame or other components. Verify the lead wires are firmly anchored. If the sensor is removed from the well for servicing, do not wipe off the heat conducting compound supplied in the well.

Refrigerant Charge

All units are designed for use with R-22 or R-410A and are shipped with a full operating charge. The operating charge for each unit is shown in the Physical Data Table.

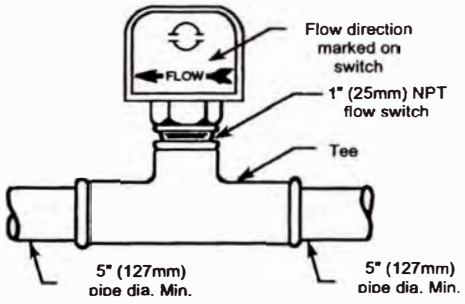
Detection of Loss of Flow

NOTE: Water pressure differential switches are not recommended for outdoor applications.

The preferred means for detecting loss of flow is the use of factory-mounted pressure differential switches for the evaporator and condenser.

A flow switch is available from McQuay (part number 00175033-00). It is a "paddle" type switch and adaptable to any pipe size from 3" (76mm) to 8" (203mm) nominal. Two flow switches are required. Mount the flow switch in either the entering or leaving water line of the evaporator and condenser. Certain minimum flow rates are required to close the switch and are listed in Table 4. Installation should be as shown in Figure 8.

Figure 8, Flow Switch



Connect the normally open contacts of the flow switch in the unit control center at terminals 62 and 63. Flow switch contact must be suitable for 24 VAC, low current (16ma).

Table 4, Flow Switch Minimum Flow Rates

Nominal Pipe Size (inches)	Min. Required Flow to Activate Switch - GPM (L/s)
5	58.7 (3.7)
6	79.2 (5)

Glycol Solutions

CAUTION

Use industrial grade glycols only. Do not use an automotive grade antifreeze. Automotive antifreeze contains inhibitors that will cause plating on the copper tubes within the chiller evaporator. The type and handling of glycol used must be consistent with local codes.

To determine flow rate for the evaporator in GPM (L/s), and pressure drop through the cooler, use the following formulas and tables.

Note: The procedure does not specify the type of glycol. Use the derate factors found in Table 5 for corrections when using ethylene glycol and those in Table 6 for propylene glycol.

1. Capacity - Multiply the chiller's capacity with water by the capacity correction factor (Cap) to find the chiller's capacity with glycol.
2. GPM - To determine evaporator GPM (or Delta-T) knowing Delta-T (or GPM) and tons:

$$\text{Glycol GPM} = \frac{24 \times tons(glycol)}{Delta - T} \times flow(\text{from table})$$

For metric applications:

L/s - To determine evaporator L/s (or Delta-T) knowing Delta-T (or L/s) and kW:

$$\text{Glycol L / s} = \frac{kW}{4.18 \times Delta - T} \times flow \text{ (from table)}$$

3. Pressure Drop - To determine pressure drop through the cooler when using glycol, enter the appropriate water pressure drop curve (begin on page 12 at the actual glycol flow. Multiply the water pressure drop found there by pressure drop adjustment factor (PD) to obtain corrected glycol pressure drop.
4. To determine the unit power consumption, multiply the unit kW/TR with water by the (kW/TR) factor. Test coolant with a clean, accurate glycol solution hydrometer (similar to that found in service stations) to determine the freezing point. Obtain percent glycol from the freezing point table below. A minimum of 25% solution by weight should be used for protection against corrosion.

Note: The effect of glycol in the condenser is negligible. As glycol increases in temperature, its properties approach those of water. For selection purposes, there is no derate in capacity for glycol in the condenser.

Table 5, Adjustment factors for ethylene glycol

%	Freeze Point						
E.G.	°F	°C	CAP.	kW/TR	COP	Flow	PD
10	26	-3	0.991	1.005	0.995	1.013	1.070
20	18	-8	0.982	1.010	0.990	1.040	1.129
30	7	-14	0.972	1.014	0.986	1.074	1.181
40	-7	-22	0.961	1.016	0.984	1.121	1.263
50	-28	-33	0.946	1.021	0.979	1.178	1.308

Table 6, Adjustment factors for propylene glycol

%	Freeze Point						
P.G.	°F	°C	CAP.	kW/TR	COP	Flow	PD
10	26	-3	0.987	1.005	0.995	1.010	1.068
20	19	-7	0.975	1.010	0.990	1.028	1.147
30	9	-13	0.962	1.017	0.983	1.050	1.248
40	-5	-21	0.946	1.026	0.975	1.078	1.366
50	-27	-33	0.929	1.039	0.962	1.116	1.481

Application Considerations

The chilled water loop must contain an adequate volume of water to prevent short cycling the chiller. Minimum water volume can be determined using the following formula:

$$\frac{\text{Design GPM X 15 Minutes}}{\text{Number of Compressors}} = \text{Volume of Water}$$

Evaporator and Condenser Water Flow and Pressure Drop

Flow rates must fall between the minimum and maximum values shown on the appropriate evaporator and condenser curves. Flow rates below the minimum values shown will result in laminar flow that will reduce efficiency, cause erratic operation of the electronic expansion valve and could cause low temperature cutouts. Flow rates exceeding the maximum values shown can cause erosion on the evaporator water connections and tubes.

Measure the chilled water pressure drop through the evaporator at field installed pressure taps. It is important not to include the effect of valves or strainers in these readings.

Do not vary the water flow through the evaporator while the compressor(s) are operating. MicroTech control setpoints are based on constant flow.

Figure 9 , Evaporator 2-pass (short shell)

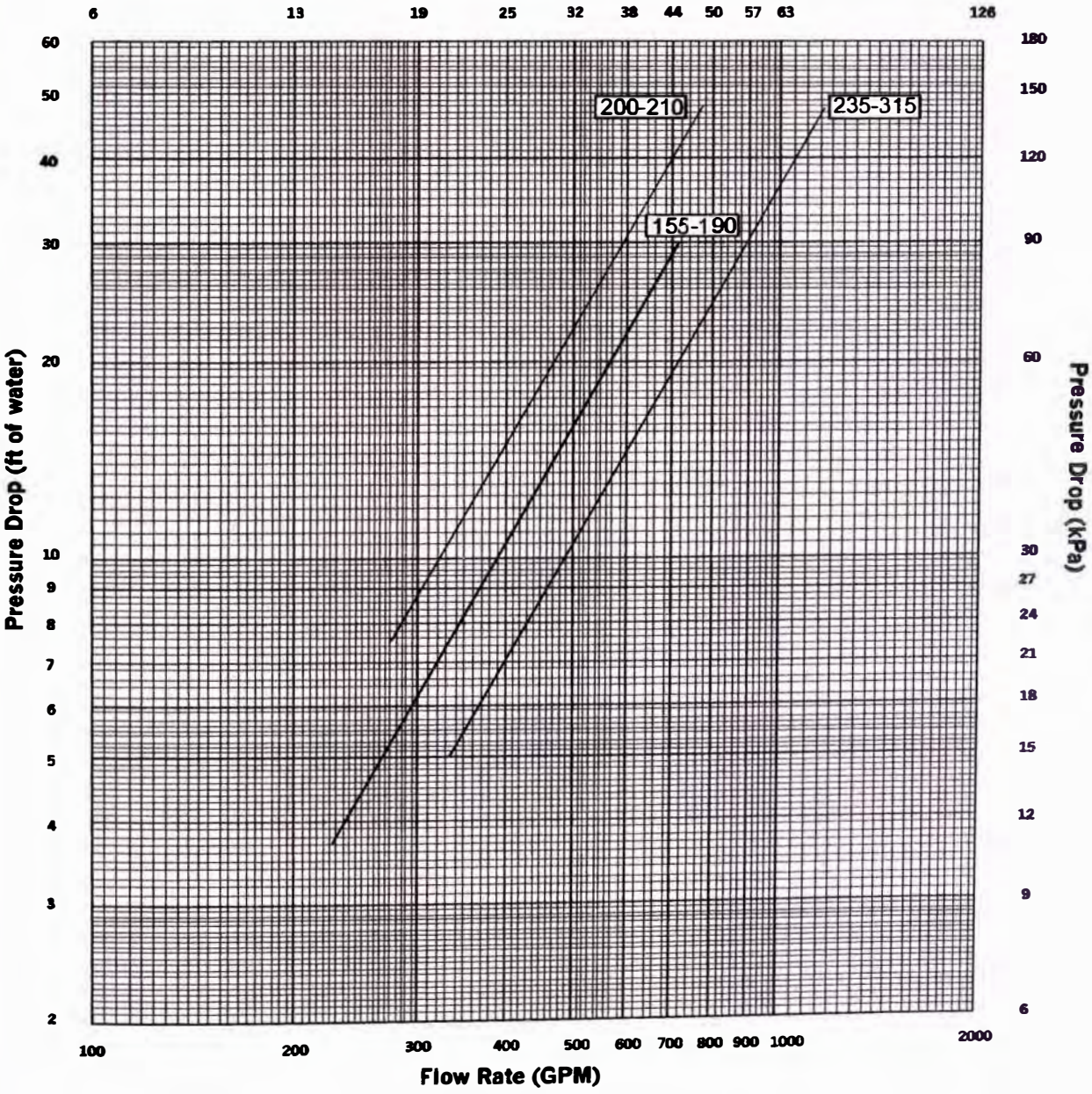


Figure 10, Evaporator 3-Pass (Short Shell)

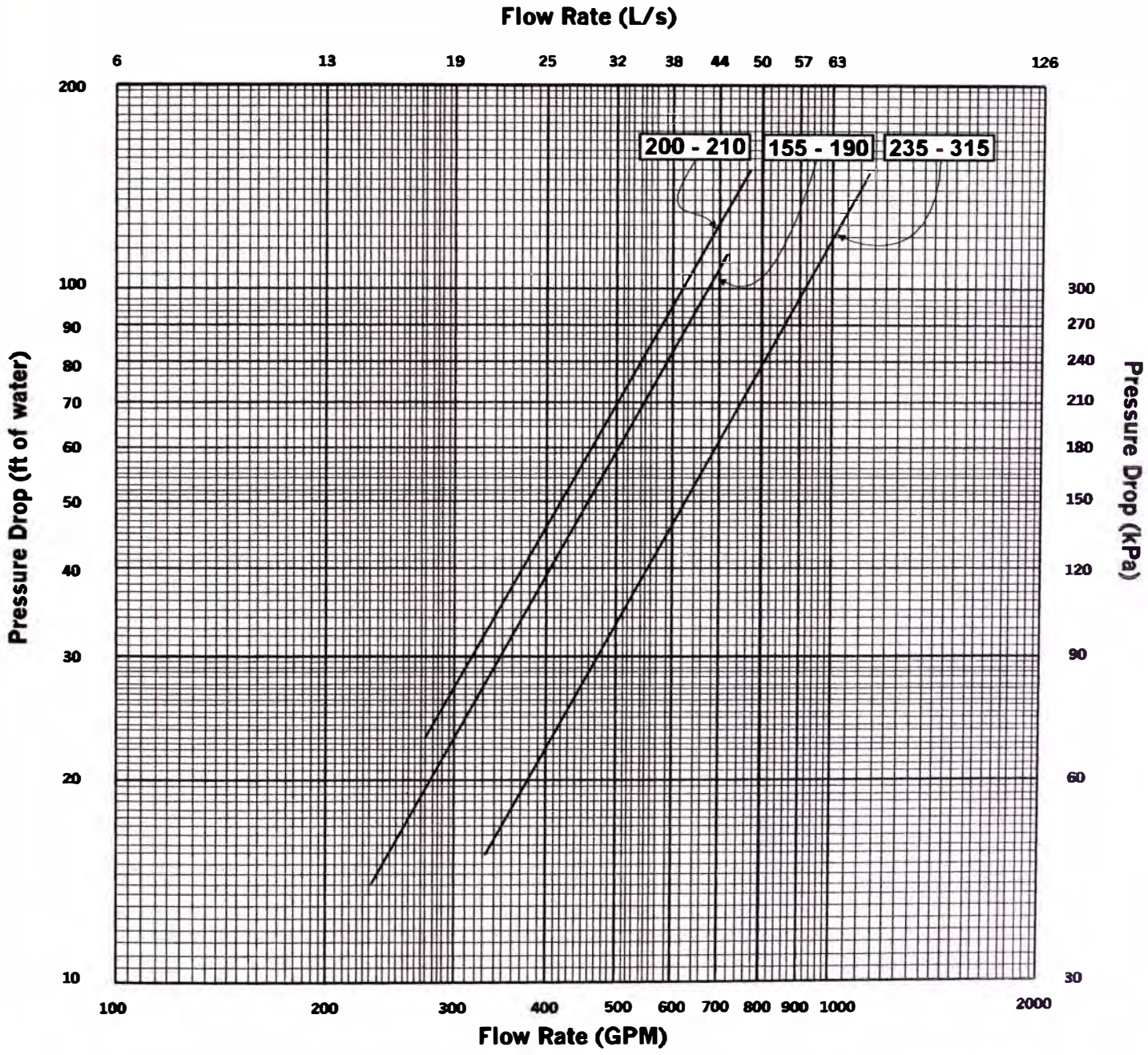


Figure 11, Condenser 1-Pass (Short Shell)

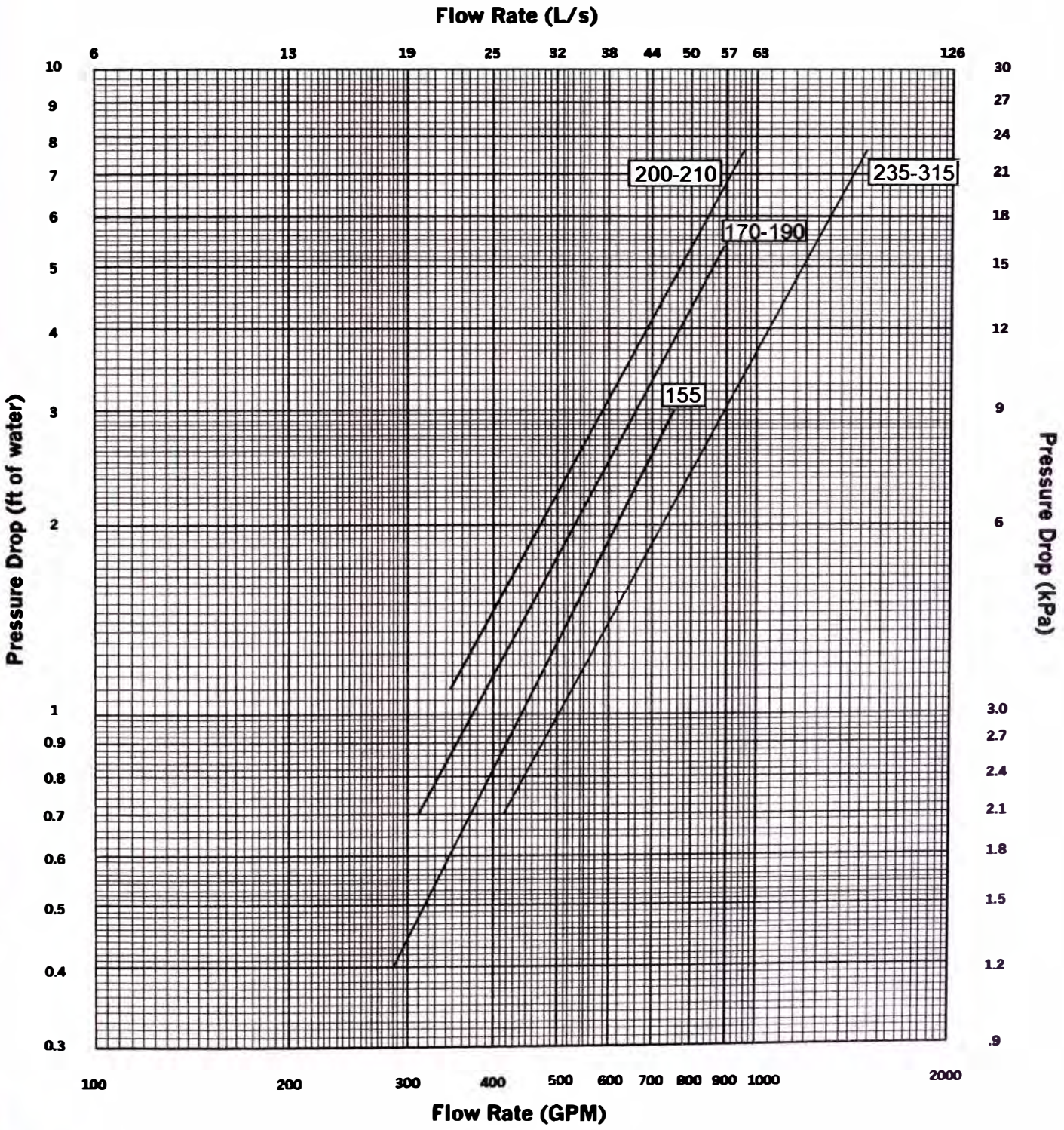


Figure 12, Condenser 2-Pass (Short Shell)

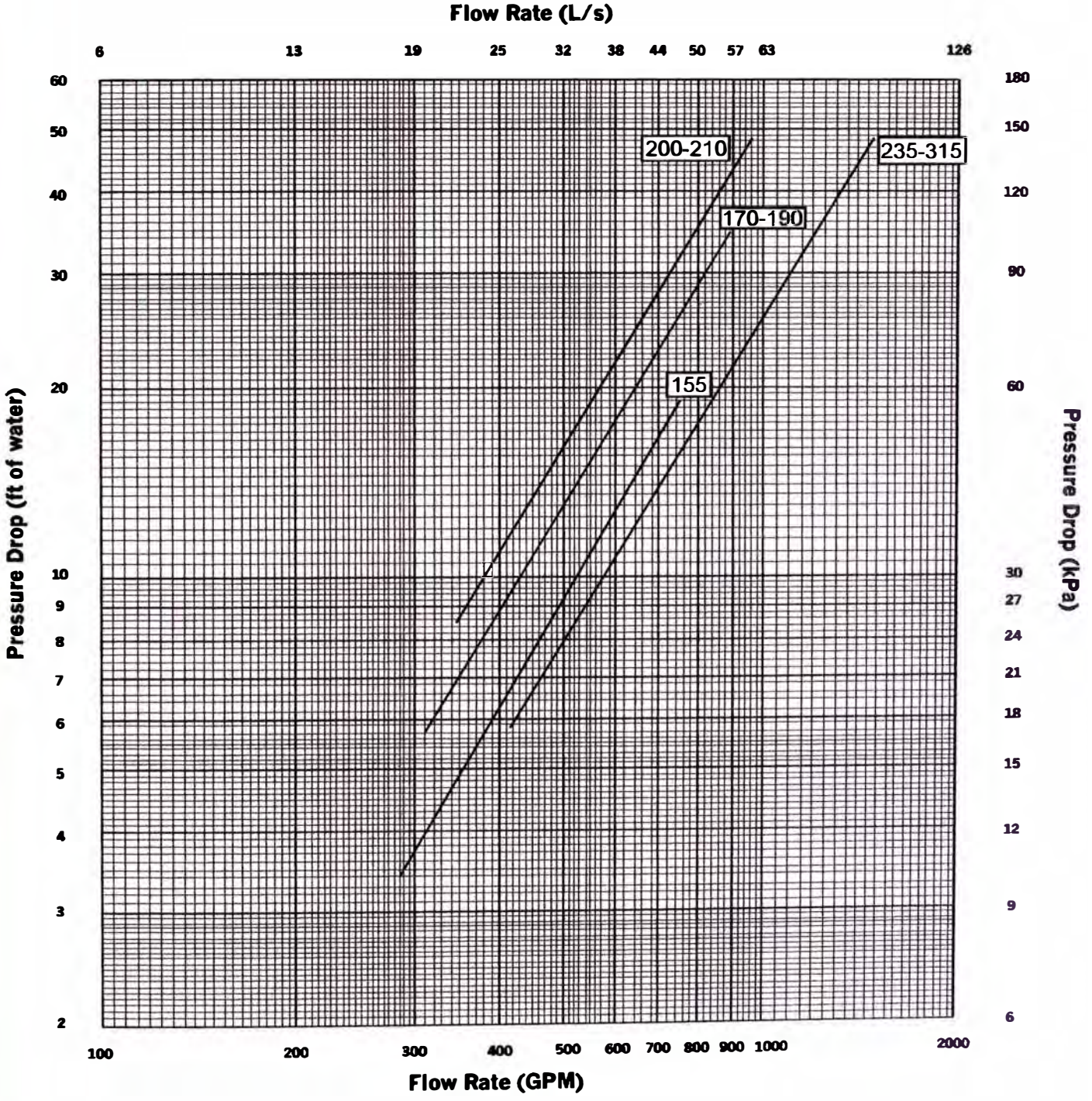


Figure 13, Condenser 3-Pass (Short Shell)

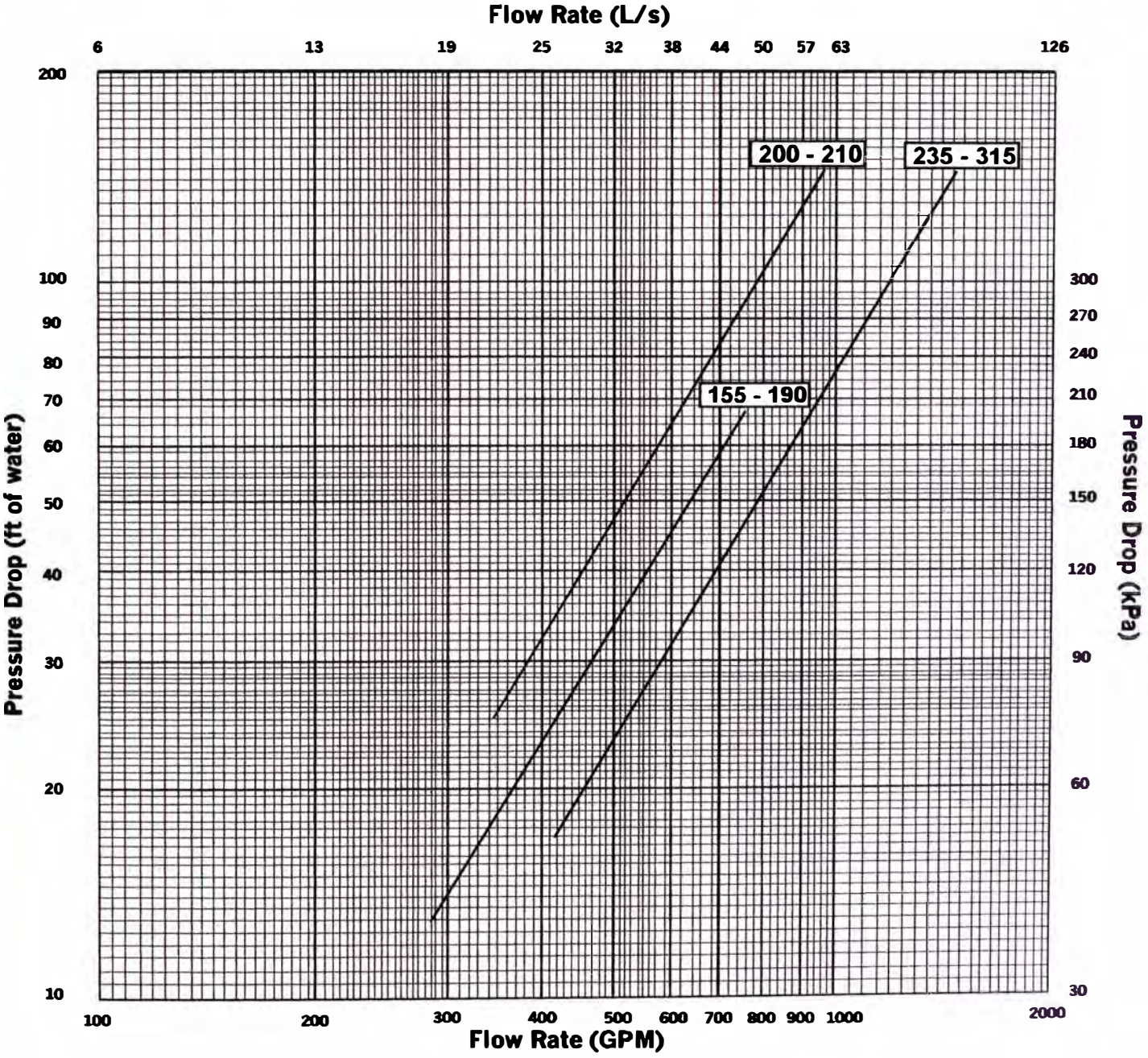


Figure 14, Evaporator 2-Pass (Standard Shell)

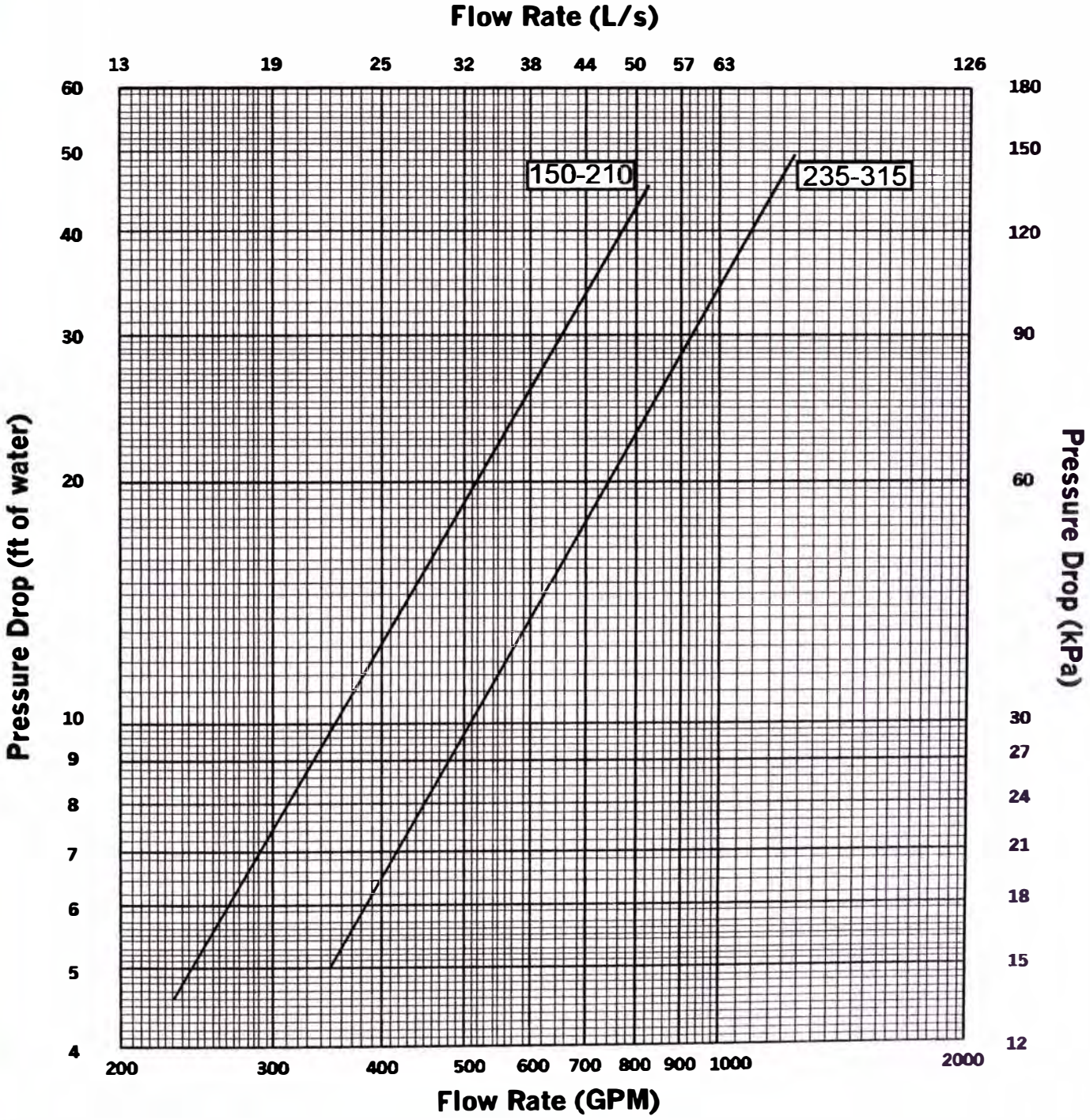


Figure 15, Evaporator 3-Pass (Standard Shell)

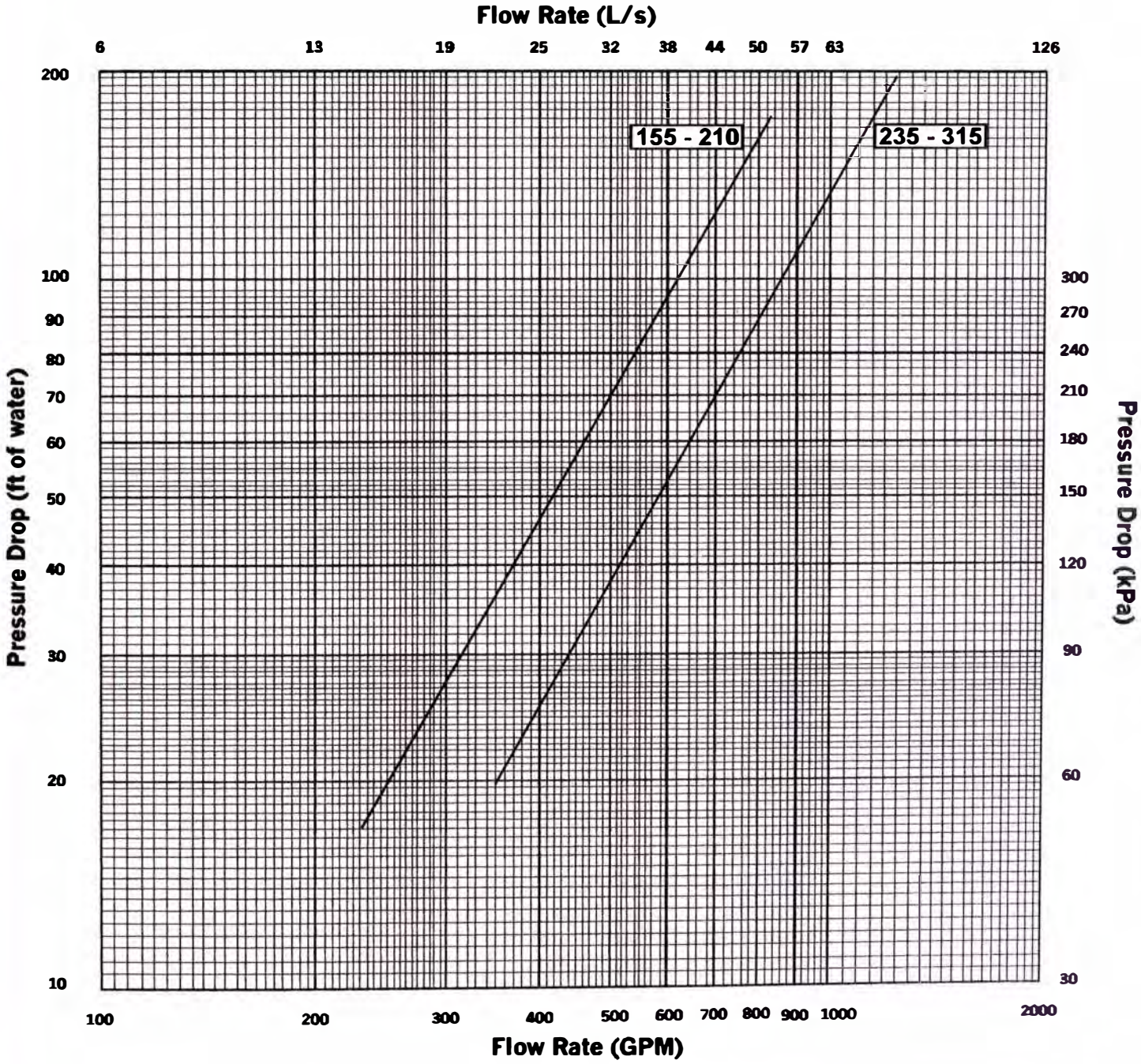


Figure 16, Condenser 1-Pass (Standard Shell)

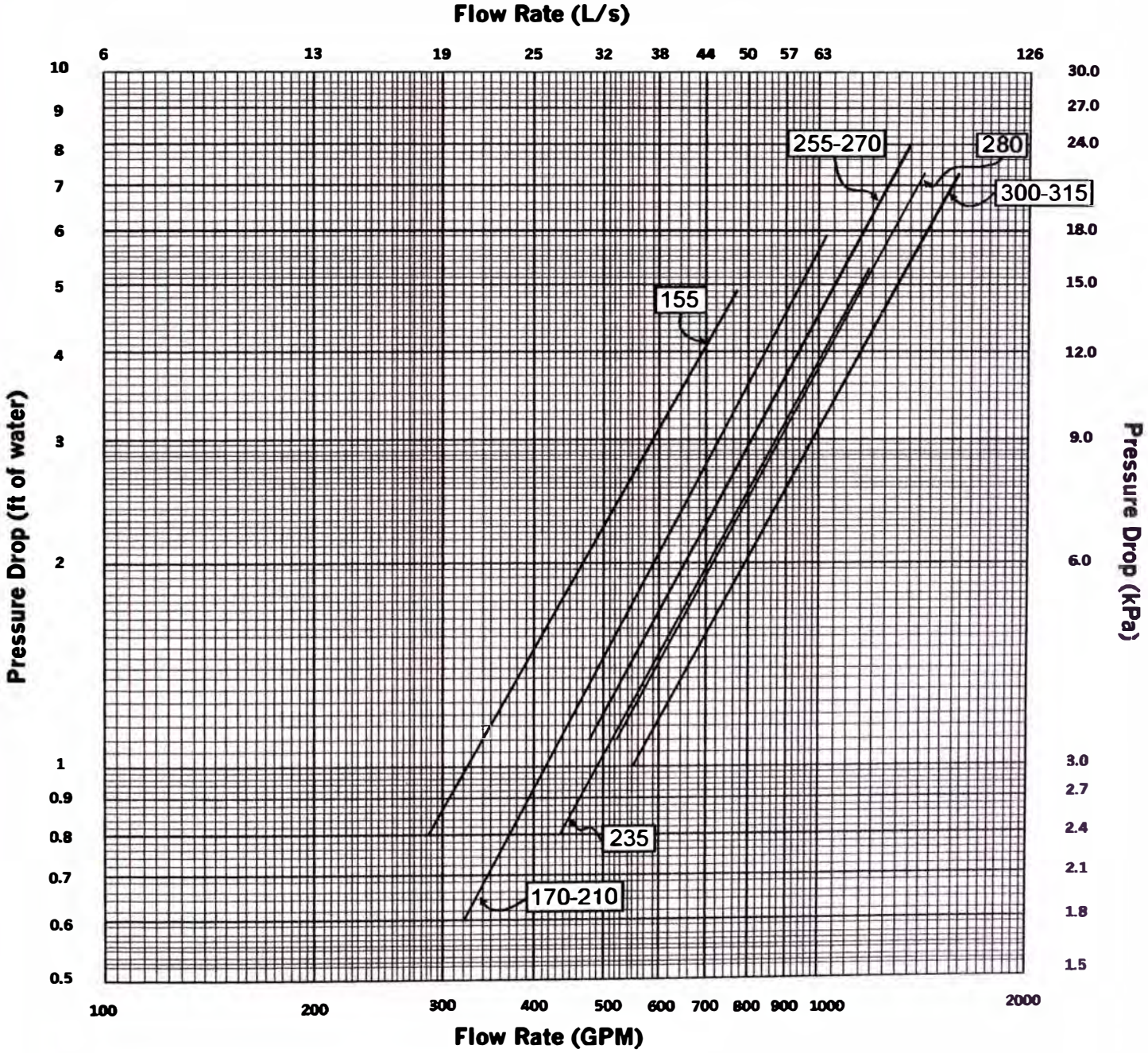


Figure 17, Condenser 2-Pass (Standard Shell)

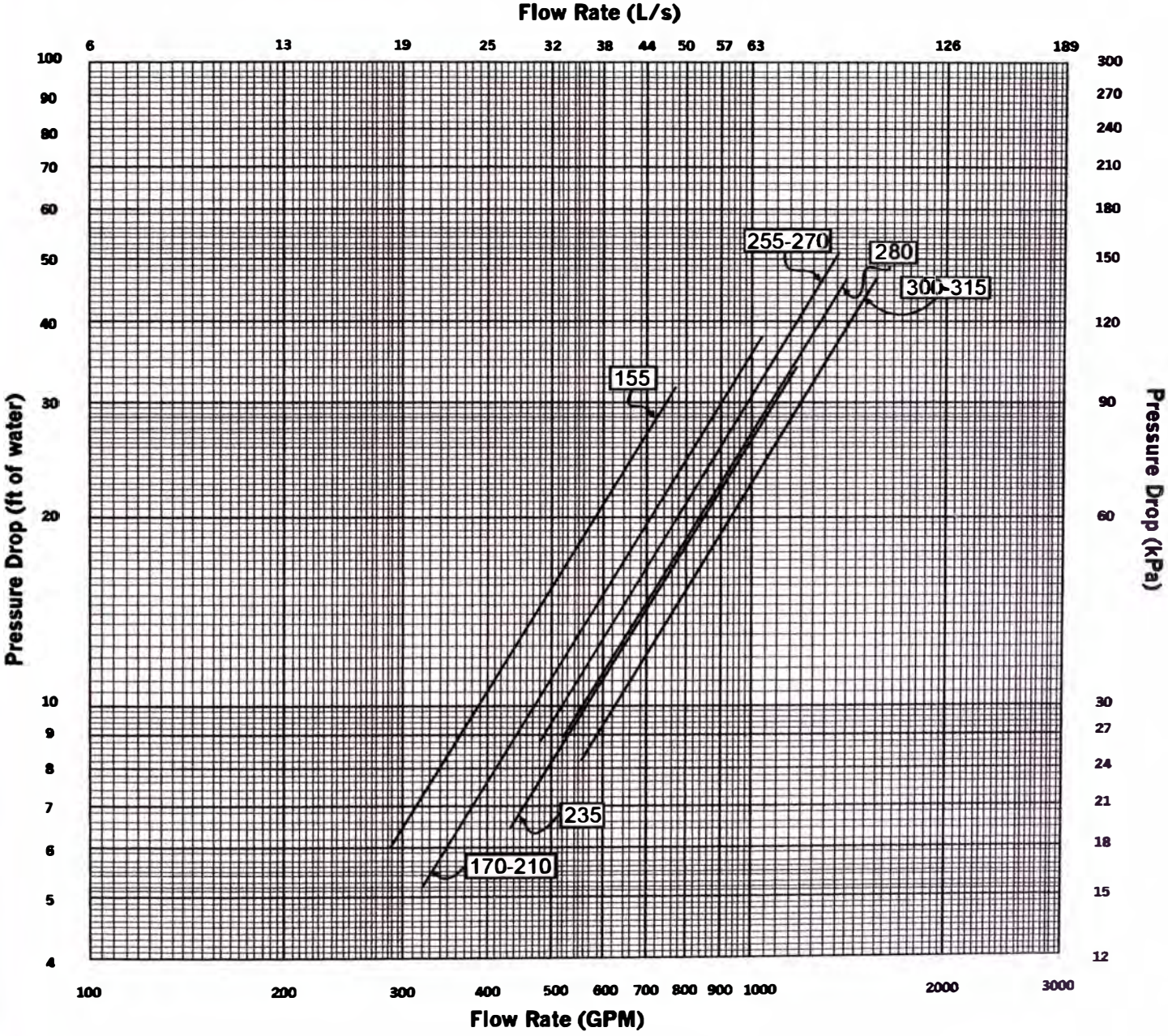


Figure 18, Condenser 3-Pass (Standard Shell)

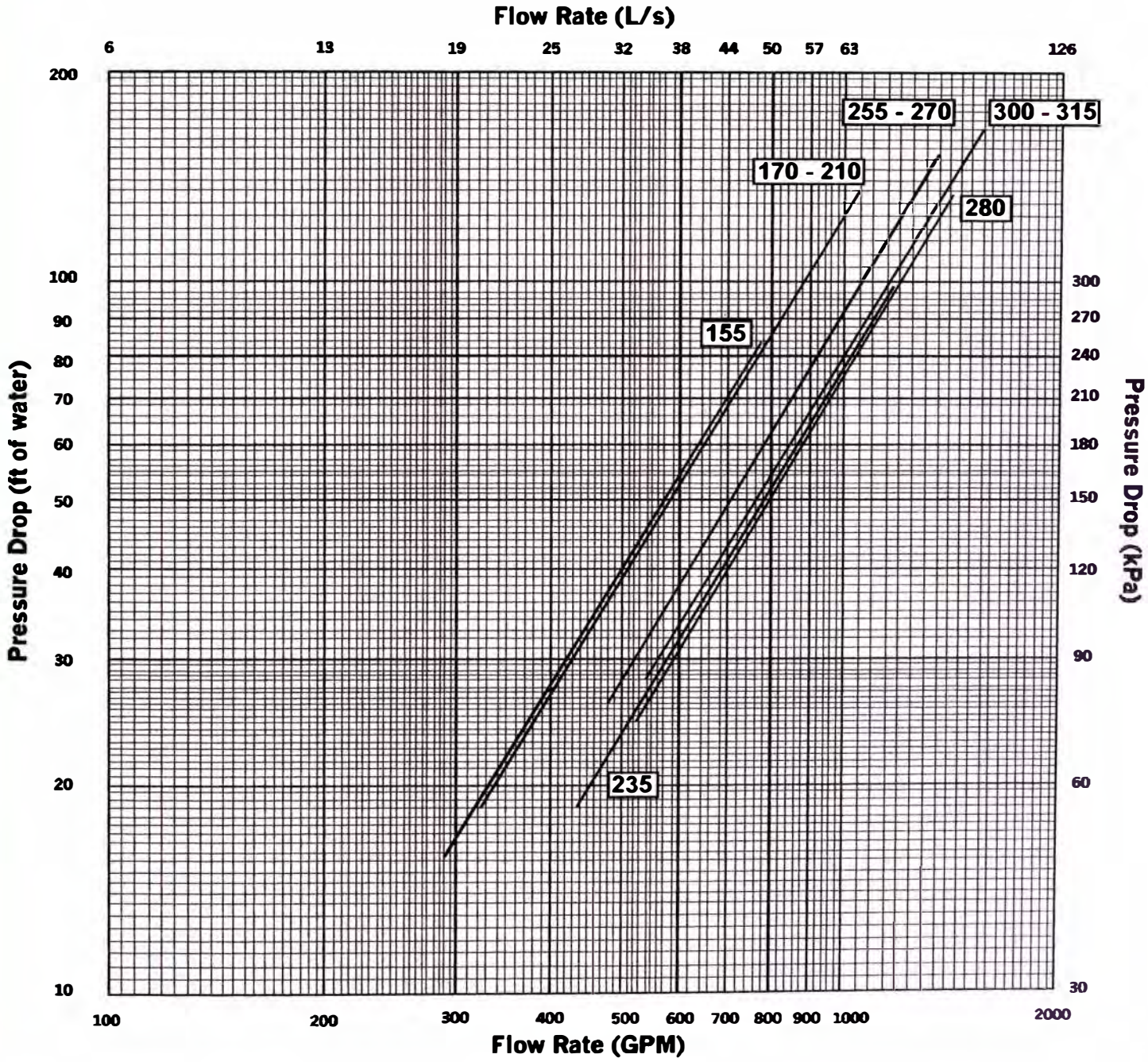


Figure 19, Evaporator 2-Pass (Long Shell)

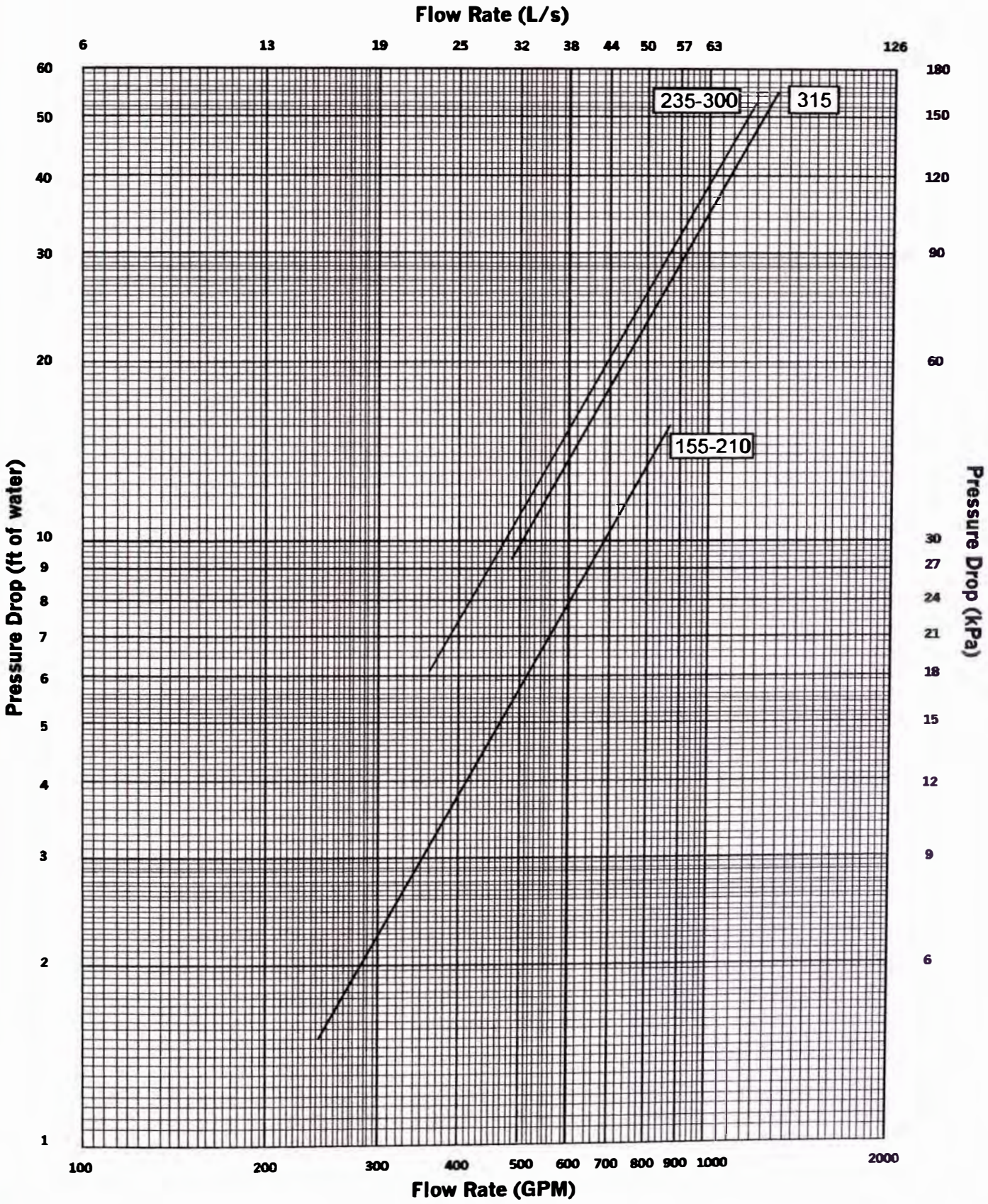


Figure 20, Evaporator 3-Pass (Long Shell)

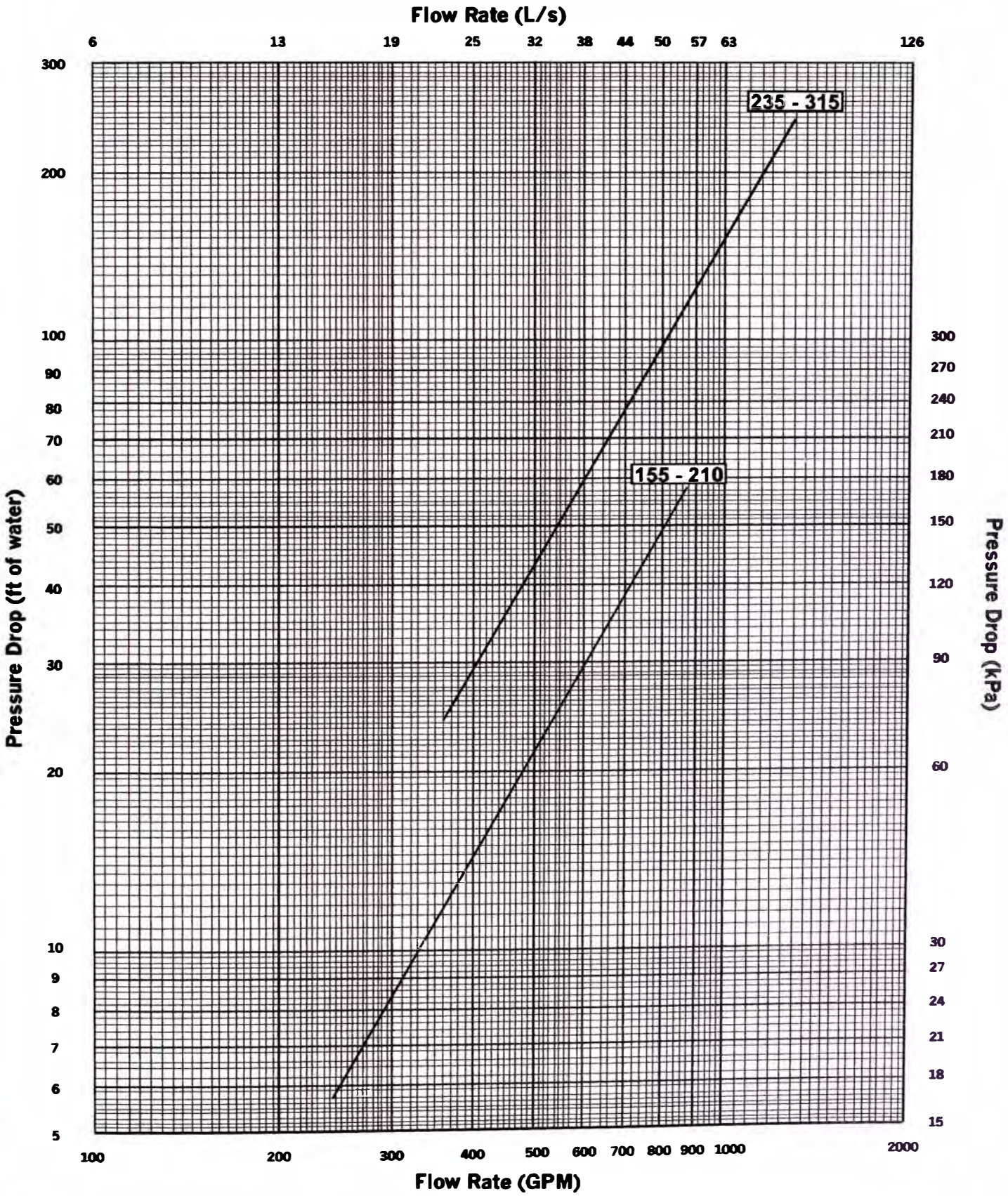


Figure 21, Condenser 1-Pass (Long Shell)

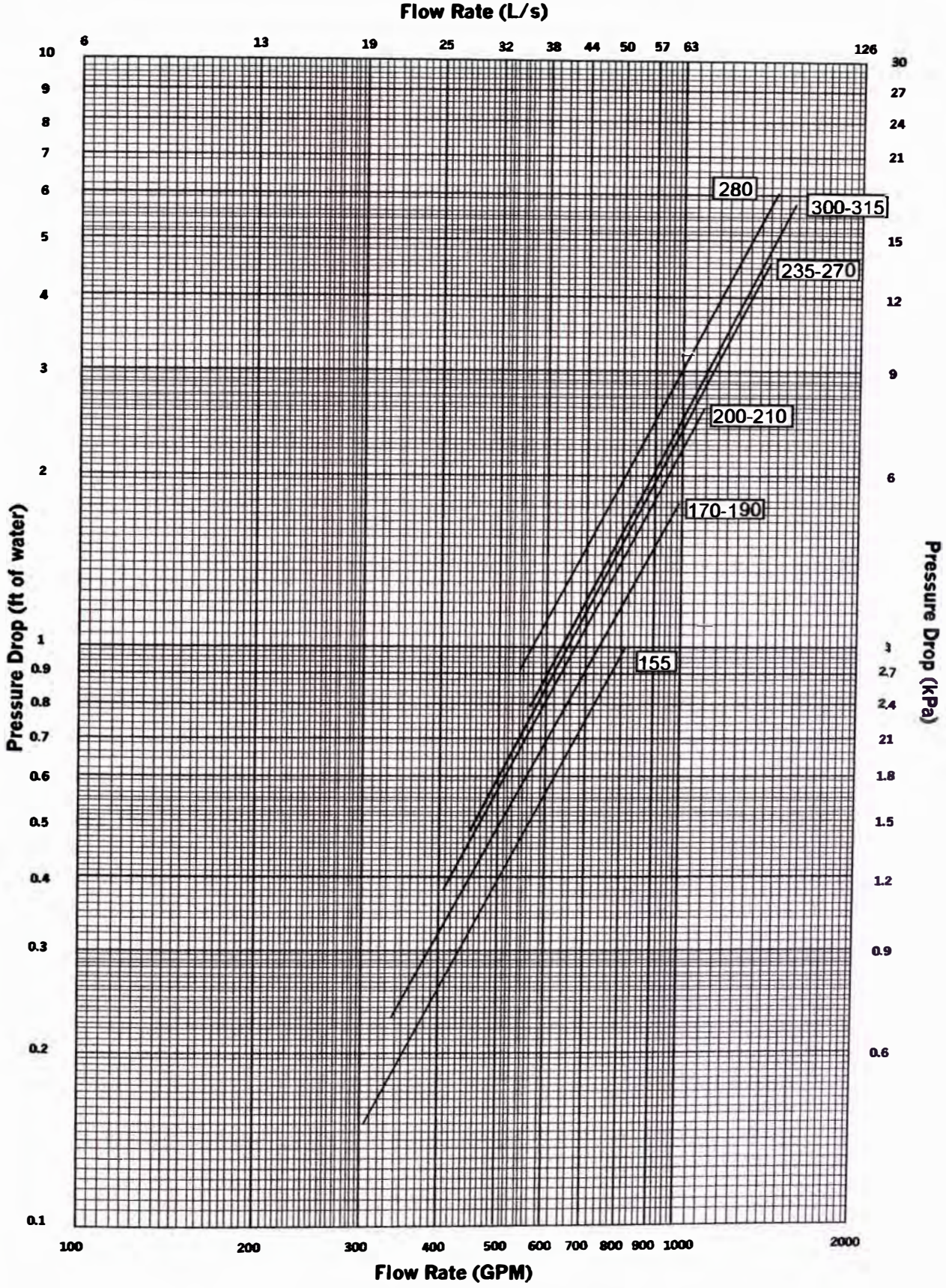


Figure 22,Condenser 2-Pass (Long Shell)

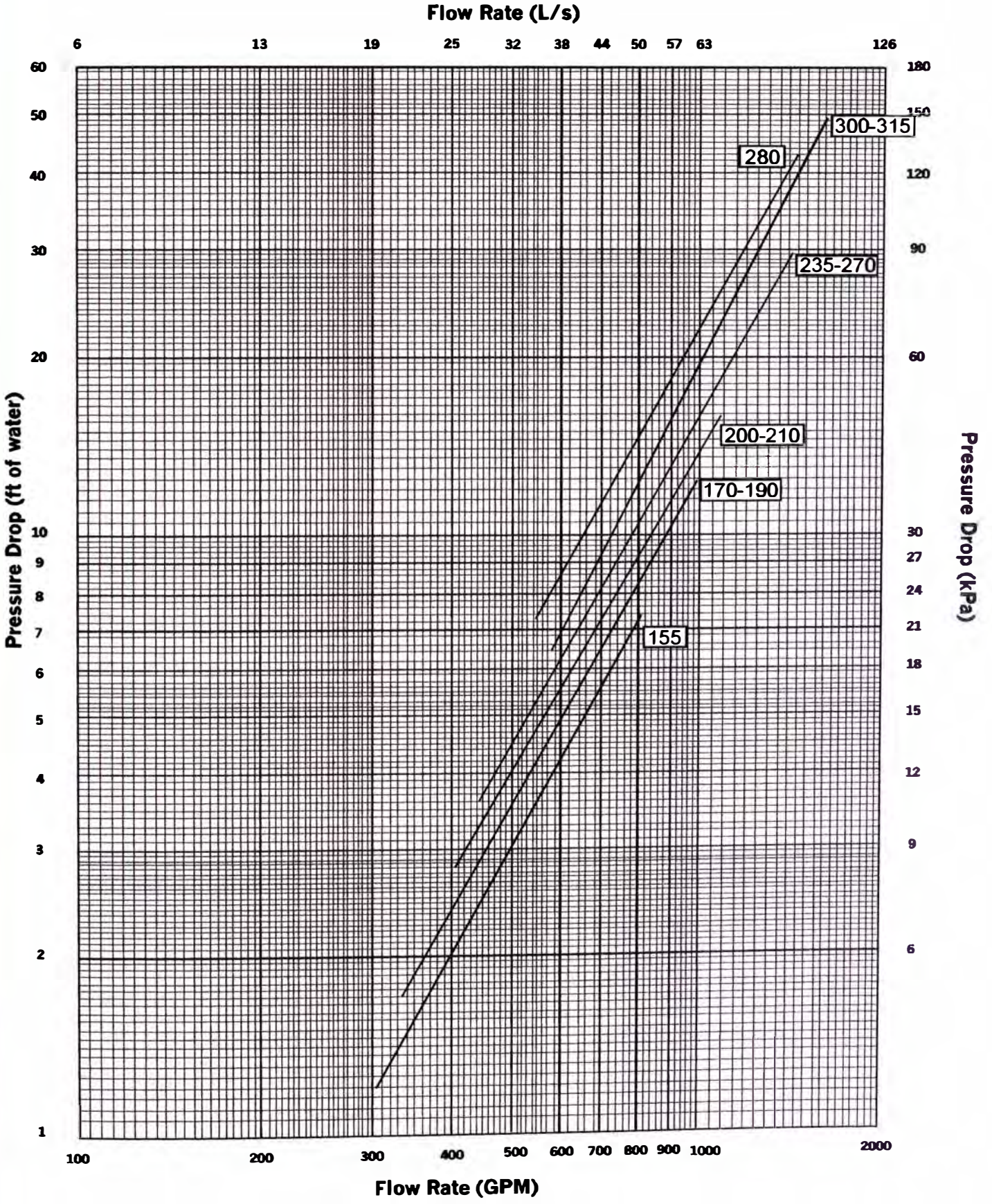
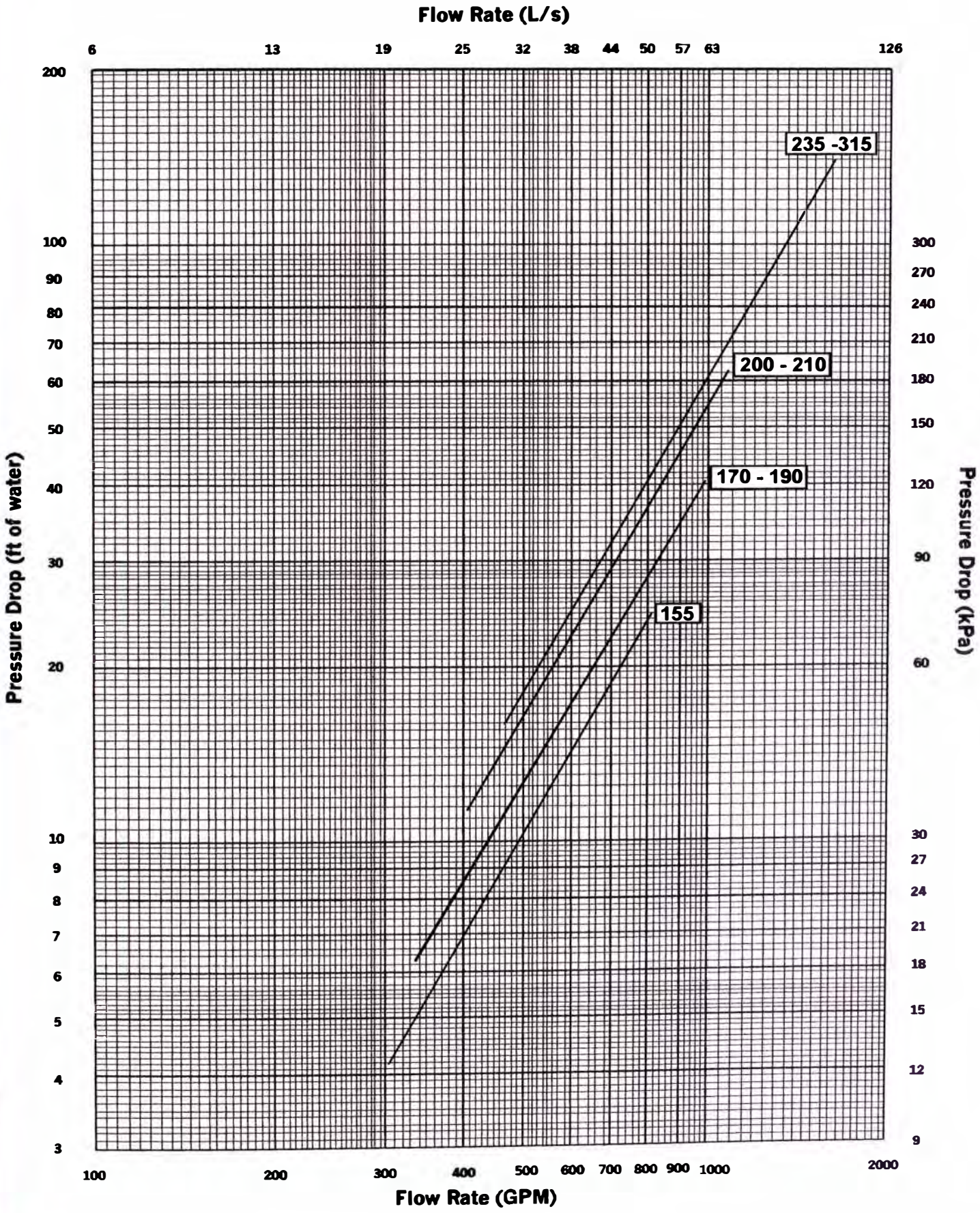


Figure 23, Condenser 3-Pass (Long Shell)



Physical Data

Table 7, Physical Data, PFS 155C - PFS 210C

Data	PFS Unit Size					
	155C	170C	180C	190C	200C	210C
BASIC DATA						
SHORT SHELL						
Unit Capacity @ ARI Conditions, tons (kW)	151.4 (532)	165.1 (581)	174.7 (614)	179.7 (632)	183.4 (645)	192.0 (675)
Unit Operating Charge R-22, lb. (kg)	582 (264)	589 (267)	589 (267)	589 (267)	607 (276)	607 (276)
Min Pumpdown Capacity R-22, lb. (kg)	689 (313)	739 (336)	739 (336)	739 (336)	770 (350)	770 (350)
Cabinet Dimensions L x W x H, in. (mm)	139.75 x 42.0 x 76.88 3550 x 1067 x 1953	139.75 x 42.0 x 76.88 3550 x 1067 x 1953	139.75 x 42.0 x 76.88 3550 x 1067 x 1953	139.75 x 42.0 x 76.88 3550 x 1067 x 1953	139.75 x 42.0 x 76.88 3550 x 1067 x 1953	139.75 x 42.0 x 76.88 3550 x 1067 x 1953
Operating Weight (with starters),lb.(kg)	9292 (4214)	9292 (4214)	9292 (4214)	9292 (4214)	9292 (4214)	9292 (4214)
Shipping Weight, (with starters),lb.(kg)	8978 (4072)	8978 (4072)	8978 (4072)	8978 (4072)	8978 (4072)	8978 (4072)
STANDARD SHELL						
Unit Capacity @ ARI Conditions, tons (kW)	154.0 (542)	171.0 (601)	181.3 (638)	186.6 (656)	196.5 (691)	206.4 (726)
Unit Operating Charge R-22, lb. (kg)	661 (300)	653 (296)	653 (296)	653 (296)	653 (296)	653 (296)
Min Pumpdown Capacity R-22, lb. (kg)	882 (400)	822 (373)	822 (373)	822 (373)	822 (373)	822 (373)
Cabinet Dimensions L x W x H, in. (mm)	162.75 x 42 x 76.88 4134 x 1067 x 1953	162.75 x 42 x 76.88 4134 x 1067 x 1953	162.75 x 42 x 76.88 4134 x 1067 x 1953	162.75 x 42 x 76.88 4134 x 1067 x 1953	162.75 x 42 x 76.88 4134 x 1067 x 1953	162.75 x 42 x 76.88 4134 x 1067 x 1953
Operating Weight (with starters),lb.(kg)	9970 (4522)	9970 (4522)	9970 (4522)	9970 (4522)	9970 (4522)	9970 (4522)
Shipping Weight, (with starters),lb.(kg)	9567 (4339)	9567 (4339)	9567 (4339)	9567 (4339)	9567 (4339)	9567 (4339)
LONG SHELL						
Unit Capacity @ ARI Conditions, tons (kW)	162.0 (570)	179.5 (631)	190.9 (671)	197.0 (693)	208.0 (731)	219.2 (771)
Unit Operating Charge R-22, lb. (kg)	984 (447)	994 (451)	994 (451)	994 (451)	953 (433)	953 (433)
Min Pumpdown Capacity R-22, lb. (kg)	1399 (635)	1478 (671)	1478 (671)	1478 (671)	1174 (533)	1174 (533)
Cabinet Dimensions L x W x H, in. (mm)	164.6 x 50.9 x 86 4180 x 1292 x 2184	164.6 x 50.9 x 86 4180 x 1292 x 2184	164.6 x 50.9 x 86 4180 x 1292 x 2184	164.6 x 50.9 x 86 4180 x 1292 x 2184	164.6 x 48.4 x 80.4 4180 x 1229 x 2042	164.6 x 48.4 x 80.4 4180 x 1229 x 2042
Operating Weight (with starters),lb.(kg)	13829 (6272)	13829 (6272)	13829 (6272)	13829 (6272)	13065 (5925)	13065 (5925)
Shipping Weight, (with starters),lb.(kg)	12651 (5737)	12651 (5737)	12651 (5737)	12651 (5737)	12037 (5459)	12037 (5459)
COMPRESSORS, SCREW, SEMI-HERMETIC						
Nominal Tons, (kW)	70 (250) | 70 (250)	70 (250) | 85 (300)	70 (250) | 100 (350)	85 (300) | 85 (300)	85 (300) | 100 (350)	100 (350) | 100 (350)
FLOODED EVAPORATOR - SHORT SHELL						
Quantity, (Number of Water Passes)	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)
Shell Diameter – Tube Length in. (mm) ft. (mm)	18 - 10 (457 - 3048)	18 - 10 (457 - 3048)	18 - 10 (457 - 3048)	18 - 10 (457 - 3048)	18 - 10 (457 - 3048)	18 - 10 (457 - 3048)
Water Volume, gallons (L)	37.4 (142)	37.4 (142)	37.4 (142)	37.4 (142)	33.2 (126)	33.2 (126)
Max. Water Pressure, psi (kPa)	150 (1035)	150 (1035)	150 (1035)	150 (1035)	150 (1035)	150 (1035)
Max. Refrigerant Pressure, psi (kPa)	250 (1725)	250 (1725)	250 (1725)	250 (1725)	250 (1725)	250 (1725)
Water Connections (Victaulic), in (mm)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)
CONDENSER - SHORT SHELL						
Quantity, (Number of Water Passes)	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)
Shell Diameter – Tube Length in. (mm) ft. (mm)	18 - 10 (457 - 3048)	18 - 10 (457 - 3048)	18 - 10 (457 - 3048)	18 - 10 (457 - 3048)	18 - 10 (457 - 3048)	18 - 10 (457 - 3048)
Water Volume, gallons (L)	45.5 (173)	40.1 (152)	40.1 (152)	40.1 (152)	36.8(140)	36.8 (140)
Max. Water Pressure, psi (kPa)	150 (1035)	150 (1035)	150 (1035)	150 (1035)	150 (1035)	150 (1035)
Max. Refrigerant Pressure, psi (kPa)	300 (2070)	300 (2070)	300 (2070)	300 (2070)	300 (2070)	300 (2070)
Water Connections (Victaulic), in (mm)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)

Table 7, Physical Data continued on next page.

Table 7, Physical Data, PFS 155C - PFS 210C (continued)

Data	PFS Unit Size 155C	170C	180C	190C	200C	210C
BASIC DATA						
FLOODED EVAPORATOR - STANDARD SHELL						
Quantity, (Number of Water Passes)	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)
Shell Diameter – Tube Length in. (mm) ft. (mm)	18 - 12 (457 - 3658)	18 - 12 (457 - 3658)	18 - 12 (457 - 3658)	18 - 12 (457 - 3658)	18 - 12 (457 - 3658)	18 - 12 (457 - 3658)
Water Volume, gallons (L)	42 (160)	42 (160)	42 (160)	42 (160)	42 (160)	36.9 (140)
Max. Water Pressure, psi (kPa)	150 (1035)	150 (1035)	150 (1035)	150 (1035)	150 (1035)	150 (1035)
Max. Refrigerant Pressure, psi (kPa)	250 (1725)	250 (1725)	250 (1725)	250 (1725)	250 (1725)	250 (1725)
Water Connections (Victaulic), in (mm)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)
CONDENSER - STANDARD SHELL						
Quantity, (Number of Water Passes)	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)
Shell Diameter – Tube Length in. (mm) ft. (mm)	18 - 12 (457 - 3658)	18 - 12 (457 - 3658)	18 - 12 (457 - 3658)	18 - 12 (457 - 3658)	18 - 12 (457 - 3658)	18 - 12 (457 - 3658)
Water Volume, gallons (L)	45.2 (171)	51.6 (196)	51.6 (196)	51.6 (196)	51.6 (196)	45.2 (171)
Max. Water Pressure, psi (kPa)	150 (1035)	150 (1035)	150 (1035)	150 (1035)	150 (1035)	150 (1035)
Max. Refrigerant Pressure, psi (kPa)	300 (2070)	300 (2070)	300 (2070)	300 (2070)	300 (2070)	300 (2070)
Water Connections (Victaulic), in (mm)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)
FLOODED EVAPORATOR - LONG SHELL						
Quantity, (Number of Water Passes)	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)
Shell Diameter – Tube Length in. (mm) ft. (mm)	24 - 12 (610 - 3658)	24 - 12 (610 - 3658)	24 - 12 (610 - 3658)	24 - 12 (610 - 3658)	24 - 12 (610 - 3658)	24 - 12 (610 - 3658)
Water Volume, gallons (L)	81.8 (310)	81.8 (310)	81.8 (310)	81.8 (310)	81.8 (310)	81.8 (310)
Max. Water Pressure, psi (kPa)	150 (1035)	150 (1035)	150 (1035)	150 (1035)	150 (1035)	150 (1035)
Max. Refrigerant Pressure, psi (kPa)	250 (1725)	250 (1725)	250 (1725)	250 (1725)	250 (1725)	250 (1725)
Water Connections (Victaulic), in (mm)	8 (204)	8 (204)	8 (204)	8 (204)	8 (204)	8 (204)
CONDENSER - LONG SHELL						
Quantity, (Number of Water Passes)	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)
Shell Diameter – Tube Length in. (mm) ft. (mm)	24 - 12 (610 - 3658)	24 - 12 (610 - 3658)	24 - 12 (610 - 3658)	24 - 12 (610 - 3658)	22 - 12 (559 - 3658)	22 - 12 (559 - 3658)
Water Volume, gallons (L)	105.9 (401)	97.5 (369)	97.5 (369)	97.5 (369)	86.9 (329)	86.9 (329)
Max. Water Pressure, psi (kPa)	150 (1035)	150 (1035)	150 (1035)	150 (1035)	150 (1035)	150 (1035)
Max. Refrigerant Pressure, psi (kPa)	300 (2070)	300 (2070)	300 (2070)	300 (2070)	300 (2070)	300 (2070)
Water Connections (Victaulic), in (mm)	8 (204)	8 (204)	8 (204)	8 (204)	8 (204)	8 (204)

Table 8, Physical Data, PFS 235C - PFS315C

Data	PFS Unit Size 235C	255C	270C	280C	300C	315C
BASIC DATA						
SHORT SHELL						
Unit Capacity @ ARI Conditions, tons (kW)	222.3 (782)	243.7 (857)	257.4 (905)	264.6 (930)	278.6 (980)	292.0 (1027)
Unit Operating Charge R-410A, lb. (kg)	772 (350)	772 (350)	772 (350)	772 (350)	772 (350)	772 (350)
Min Pumpdown Capacity R-410A, lb. (kg)	793 (360)	793 (360)	793 (360)	793 (360)	793 (360)	793 (360)
Cabinet Dimensions L x W x H, in. (mm)	140.75 x 43.9 x 84.25 3575 x 1115 x 2140	140.75 x 43.9 x 84.25 3575 x 1115 x 2140	140.75 x 43.9 x 84.25 3575 x 1115 x 2140	140.75 x 43.9 x 84.25 3575 x 1115 x 2140	140.75 x 43.9 x 84.25 3575 x 1115 x 2140	140.75 x 43.9 x 84.25 3575 x 1115 x 2140
Operating Weight (with starters),lb.(kg)	10726 (4864)	10726 (4864)	10726 (4864)	10726 (4864)	10726 (4864)	10726 (4864)
Shipping Weight, (with starters),lb.(kg)	10185 (4619)	10185 (4619)	10185 (4619)	10185 (4619)	10185 (4619)	10185 (4619)
STANDARD SHELL						
Unit Capacity @ ARI Conditions, tons (kW)	233.0 (819)	256.0 (900)	270.9 (953)	280.1 (985)	296.2 (1041)	311.0 (1094)
Unit Operating Charge R-410A, lb. (kg)	857 (389)	862 (391)	862 (391)	857 (389)	851 (386)	851 (386)
Min Pumpdown Capacity R-410A, lb. (kg)	915 (415)	946 (429)	946 (429)	915 (415)	876 (398)	876 (398)
Cabinet Dimensions L x W x H, in. (mm)	163.75 x 43.9 x 84.25 4159 x 1115 x 2140	163.75 x 43.9 x 84.25 4159 x 1115 x 2140	163.75 x 43.9 x 84.25 4159 x 1115 x 2140	163.75 x 43.9 x 84.25 4159 x 1115 x 2140	163.75 x 43.9 x 84.25 4159 x 1115 x 2140	163.75 x 43.9 x 84.25 4159 x 1115 x 2140
Operating Weight (with starters),lb.(kg)	12060 (5469)	12060 (5469)	12060 (5469)	12060 (5469)	12060 (5469)	12060 (5469)
Shipping Weight, (with starters),lb.(kg)	11300 (5125)	11300 (5125)	11300 (5125)	11300 (5125)	11300 (5125)	11300 (5125)

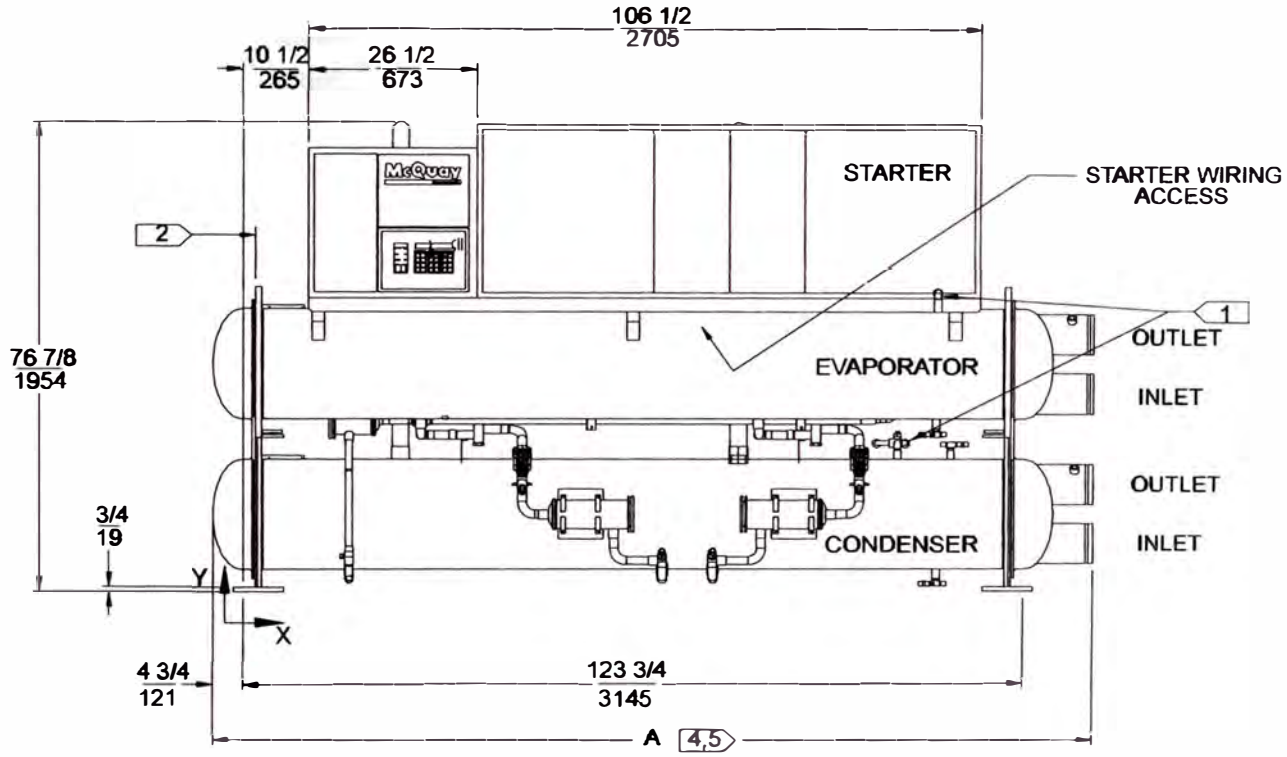
Table 8, Physical Data, PFS 235C - PFS315C continued on next page.

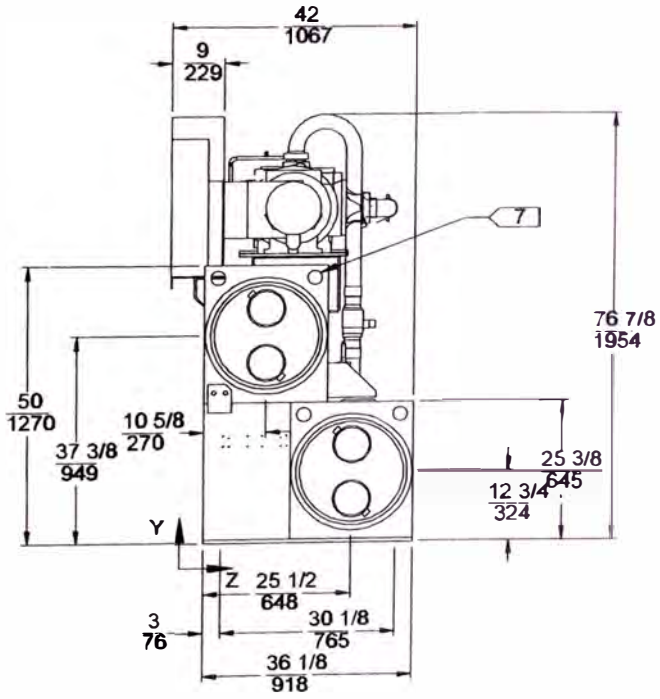
Table 8, Physical Data, PFS 235C - 315C (continued)

Data	PFS Unit Size					
	235C	255C	270C	280C	300C	315C
LONG SHELL						
Unit Capacity @ ARI Conditions, tons (kW)	239.7 (843)	265.1 (932)	281.4 (989)	289.0 (1016)	305.8 (1075)	323.6 (1131)
Unit Operating Charge R-410A lb. (kg)	993 (451)	993 (451)	993 (451)	1004 (456)	993 (451)	982 (446)
Min Pumpdown Capacity R-410A, lb. (kg)	1220 (554)	1220 (554)	1220 (554)	1296 (588)	1220 (554)	1220 (554)
Cabinet Dimensions L x W x H, in. (mm)	188.75 x 43.9 x 84.25 4794 x 1115 x 2140	188.75 x 43.9 x 84.25 4794 x 1115 x 2140	188.75 x 43.9 x 84.25 4794 x 1115 x 2140	188.75 x 43.9 x 84.25 4794 x 1115 x 2140	188.75 x 43.9 x 84.25 4794 x 1115 x 2140	188.75 x 43.9 x 84.25 4794 x 1115 x 2140
Operating Weight (with starters),lb.(kg)	13928 (6317)	13928 (6317)	13928 (6317)	13928 (6317)	13928 (6317)	13928 (6317)
Shipping Weight, (with starters),lb.(kg)	12904 (5852)	12904 (5852)	12904 (5852)	12904 (5852)	12904 (5852)	12904 (5852)
COMPRESSORS, SCREW, SEMI-HERMETIC						
Nominal Tons, (kW)	105 (365) | 105 (365)	105 (365) | 125 (445)	105 (365) | 150 (520)	125 (465) | 125 (465)	125 (445) | 150 (520)	150 (520) | 150 (520)
FLOODED EVAPORATOR - SHORT SHELL						
Quantity, (Number of Water Passes)	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)
Shell Diameter – Tube Length in. (mm) ft. (mm)	22 - 10 (559 - 3048)	22 - 10 (559 - 3048)	22 - 10 (559 - 3048)	22 - 10 (559 - 3048)	22 - 10 (559 - 3048)	22 - 10 (559 - 3048)
Water Volume, gallons (L)	51.2 (194)	51.2 (194)	51.2 (194)	51.2 (194)	51.2 (194)	51.2 (194)
Max. Water Pressure, psi (kPa)	150 (1035)	150 (1035)	150 (1035)	150 (1035)	150 (1035)	150 (1035)
Max. Refrigerant Pressure, psi (kPa)	400 (2760)	400 (2760)	400 (2760)	400 (2760)	400 (2760)	400 (2760)
Water Connections (Victaulic), in (mm)	8 (204)	8 (204)	8 (204)	8 (204)	8 (204)	8 (204)
CONDENSER - SHORT SHELL						
Quantity, (Number of Water Passes)	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)
Shell Diameter – Tube Length in. (mm) ft. (mm)	20 - 10 (508 - 3048)	20 - 10 (508 - 3048)	20 - 10 (508 - 3048)	20 - 10 (508 - 3048)	20 - 10 (508 - 3048)	20 - 10 (508 - 3048)
Water Volume, gallons (L)	50.8 (193)	50.8 (193)	50.8 (193)	50.8 (193)	50.8 (193)	50.8 (193)
Max. Water Pressure, psi (kPa)	150 (1035)	150 (1035)	150 (1035)	150 (1035)	150 (1035)	150 (1035)
Max. Refrigerant Pressure, psi (kPa)	475 (3278)	475 (3278)	475 (3278)	475 (3278)	475 (3278)	475 (3278)
Water Connections (Victaulic), in (mm)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)
FLOODED EVAPORATOR - STANDARD SHELL						
Quantity, (Number of Water Passes)	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)
Shell Diameter – Tube Length in. (mm) ft. (mm)	22 - 12 (559 - 3658)	22 - 12 (559 - 3658)	22 - 12 (559 - 3658)	22 - 12 (559 - 3658)	22 - 12 (559 - 3658)	22 - 12 (559 - 3658)
Water Volume, gallons (L)	62.2 (236)	62.2 (236)	62.2 (236)	62.2 (236)	62.2 (236)	62.2 (236)
Max. Water Pressure, psi (kPa)	150 (1035)	150 (1035)	150 (1035)	150 (1035)	150 (1035)	150 (1035)
Max. Refrigerant Pressure, psi (kPa)	400 (2760)	400 (2760)	400 (2760)	400 (2760)	400 (2760)	400 (2760)
Water Connections (Victaulic), in (mm)	8 (204)	8 (204)	8 (204)	8 (204)	8 (204)	8 (204)
CONDENSER - STANDARD SHELL						
Quantity, (Number of Water Passes)	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)
Shell Diameter – Tube Length in. (mm) ft. (mm)	20 - 12 (508 - 3658)	20 - 12 (508 - 3658)	20 - 12 (508 - 3658)	20 - 12 (508 - 3658)	20 - 12 (508 - 3658)	20 - 12 (508 - 3658)
Water Volume, gallons (L)	61.3 (232)	57.6 (218)	57.6 (218)	61.3 (232)	66.0 (250)	66.0 (250)
Max. Water Pressure, psi (kPa)	150 (1035)	150 (1035)	150 (1035)	150 (1035)	150 (1035)	150 (1035)
Max. Refrigerant Pressure, psi (kPa)	475 (3278)	475 (3278)	475 (3278)	475 (3278)	475 (3278)	475 (3278)
Water Connections (Victaulic), in (mm)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)
FLOODED EVAPORATOR - LONG SHELL						
Quantity, (Number of Water Passes)	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)
Shell Diameter – Tube Length in. (mm) ft. (mm)	22 - 14 (559 - 4267)	22 - 14 (559 - 4267)	22 - 14 (559 - 4267)	22 - 14 (559 - 4267)	22 - 14 (559 - 4267)	22 - 14 (559 - 4267)
Water Volume, gallons (L)	69.5 (263)	69.5 (263)	69.5 (263)	69.5 (263)	69.5 (263)	72.6 (275)
Max. Water Pressure, psi (kPa)	150 (1035)	150 (1035)	150 (1035)	150 (1035)	150 (1035)	150 (1035)
Max. Refrigerant Pressure, psi (kPa)	400 (2760)	400 (2760)	400 (2760)	400 (2760)	400 (2760)	400 (2760)
Water Connections (Victaulic), in (mm)	8 (204)	8 (204)	8 (204)	8 (204)	8 (204)	8 (204)
CONDENSER - LONG SHELL						
Quantity, (Number of Water Passes)	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)
Shell Diameter – Tube Length in. (mm) ft. (mm)	22 - 14 (559 - 4267)	22 - 14 (559 - 4267)	22 - 14 (559 - 4267)	22 - 14 (559 - 4267)	22 - 14 (559 - 4267)	22 - 14 (559 - 4267)
Water Volume, gallons (L)	98.6 (373)	98.6 (373)	98.6 (373)	89.2 (339)	98.6 (373)	98.6 (373)
Max. Water Pressure, psi (kPa)	150 (1035)	150 (1035)	150 (1035)	150 (1035)	150 (1035)	150 (1035)
Max. Refrigerant Pressure, psi (kPa)	475 (3278)	475 (3278)	475 (3278)	475 (3278)	475 (3278)	475 (3278)
Water Connections (Victaulic), in (mm)	8 (204)	8 (204)	8 (204)	8 (204)	8 (204)	8 (204)

Dimensional Data

Figure 24, Short shell R-22 Refrigerant





All dimensions are shown in inches and (mm).

Overall Length A			Overall Height (Note 13)	Overall Width With Starter
1 & 3 Pass	2 & 4 Pass Head Conn. On Same End	2 & 4 Pass Head Conn. Both Ends		
146 1/4 (3715)	139 3/4 (3550)	146 1/4 (3715)	76 7/8 (1953)	42 (1067)

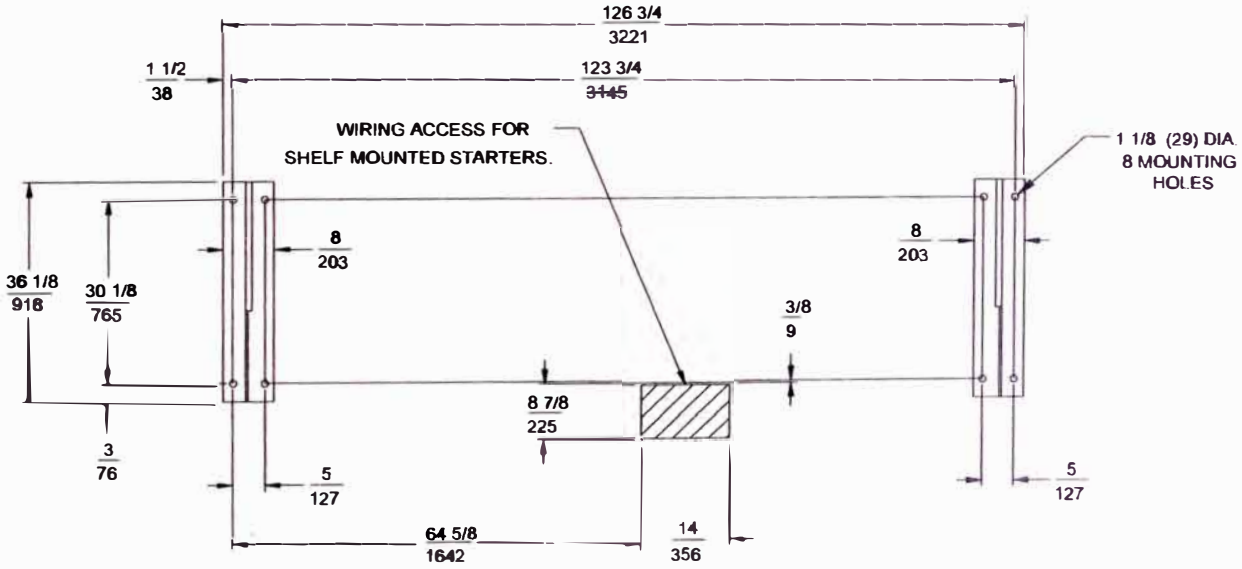
Center of Gravity with Starter			
X	Y	Z	see note 12
64 7/8 65	36 1/2 8	13 5/8 (346)	Oper.
72 3/4 (1651)	36 3/4 (899)	13 3/4 (349)	Ship

See notes on next page.

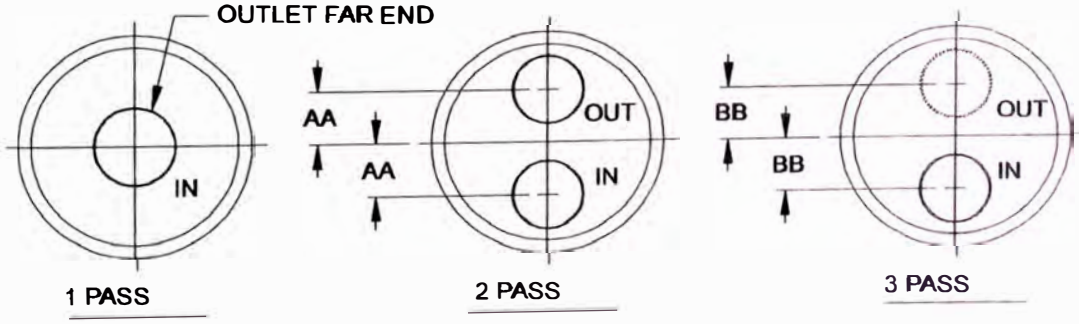
Notes for Figure 24:

1. One half inch (13) FPT evaporator and condenser relief valves must be piped per ANSI/ASHRAE 15. (1 for each evaporator, 2 for each condenser).
2. 144 inches (3658) is required at either end of the tubesheet for tube replacement. 36 inches (914) is recommended on all other sides and top for service clearance.
3. Final connections must allow for manufacturing tolerance.
4. Standard heads are shown. For dimensions of high pressure construction, water boxes, or flange type connections, contact your representative.
5. For dimensions of different condenser or evaporator pass see table.
6. Unit is shipped with an operating charge of refrigerant and oil.
7. Six 2 1/2 inch (64) dia. Lifting holes are provided.
8. All water connections are given in standard U.S. Pipe sizes. Standard connections are suitable for welding or victualic couplings.
9. Vibration isolator pads are provided for field installation 0.25 inches (6) thick when loaded.
10. If main power wiring is brought up through the floor, this wiring must be outside the envelope of the unit.
11. Pumpdown capacity is determined in accordance with ANSI/ASHRAE 15 for the maximum tube count.
12. These values are for units with standard wall thickness copper tubing only.
13. The shipping skid adds 4 inches (102) to the overall unit height.

Figure 24 , Short shell dimensions R-22 Refrigerant (continued)

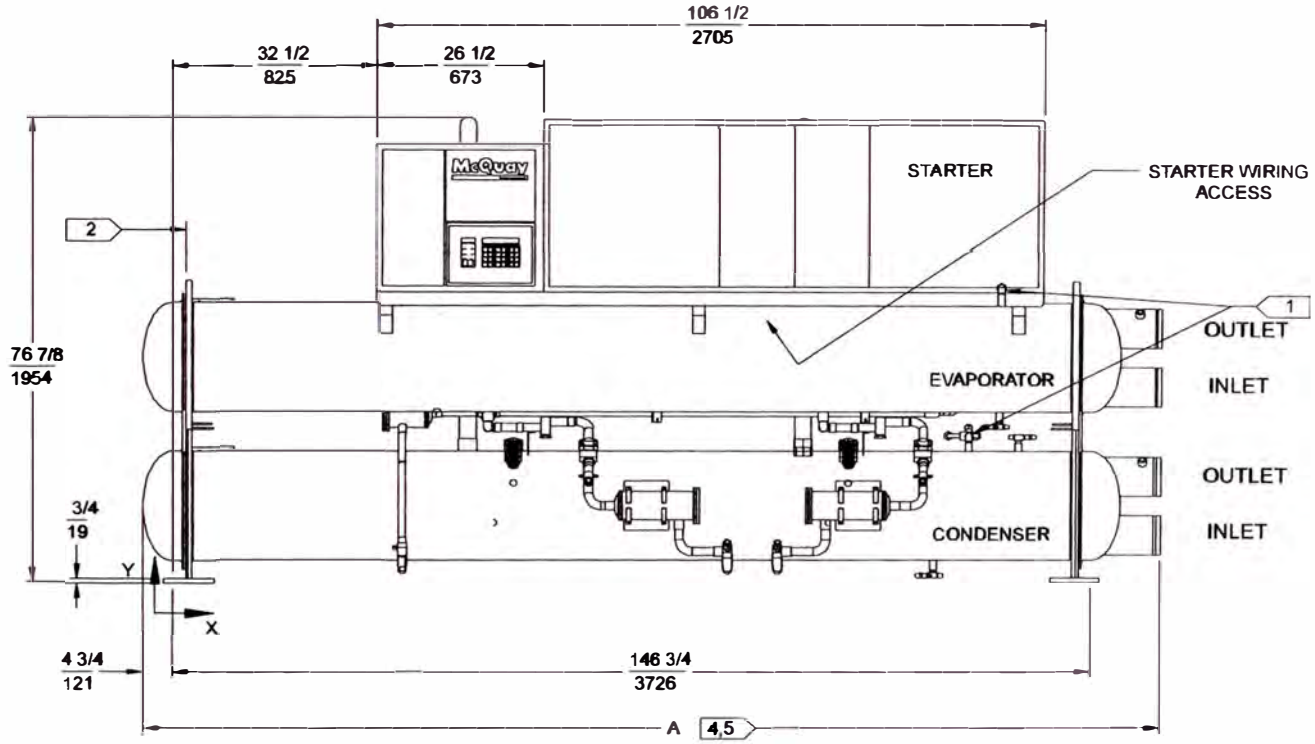


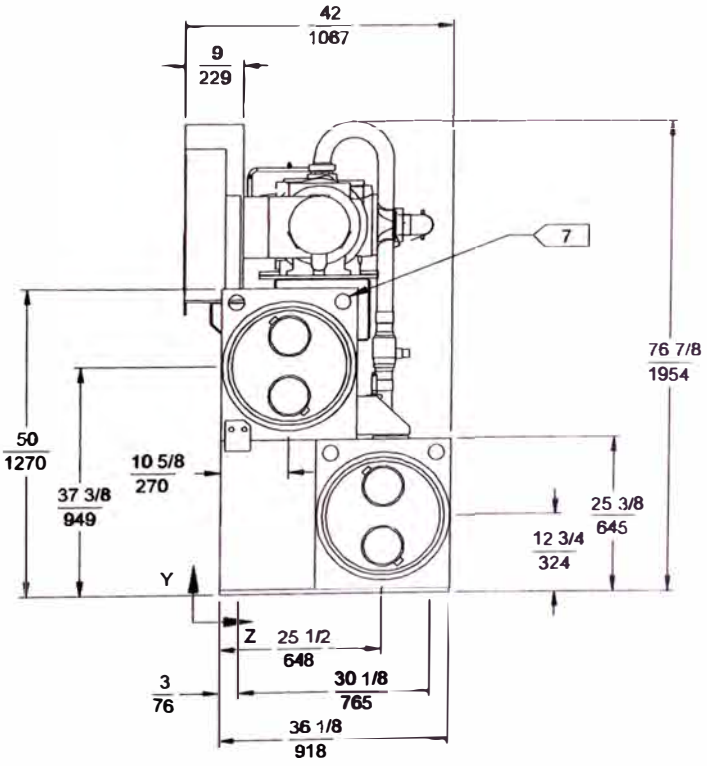
NOZZLE SIZES AND LOCATIONS
DIMENSIONS In INCHES (MM)



Vessel Code		Head Connection U.S. Pipe Size			AA	BB
Evap.	Cond.	1P	2P	3P		
E1810		8	6	5	4 7/8 (124)	4 7/8 (124)
	C1810	8	6	5	4 7/8 (124)	4 7/8 (124)

Figure 25, Standard shell dimemsions R-22 Refrigerant





All dimensions are shown in inches and (mm)

Overall Length A			Overall Height (Note 13)	Overall Width With Starter
1 & 3 Pass	2 & 4 Pass Head Conn on same end	2 & 4 Pass Head Conn. both ends		
169 1/4 (4299)	162 3/4 (4134)	169 1/4 (4299)	76 7/8 (1953)	42 (1067)

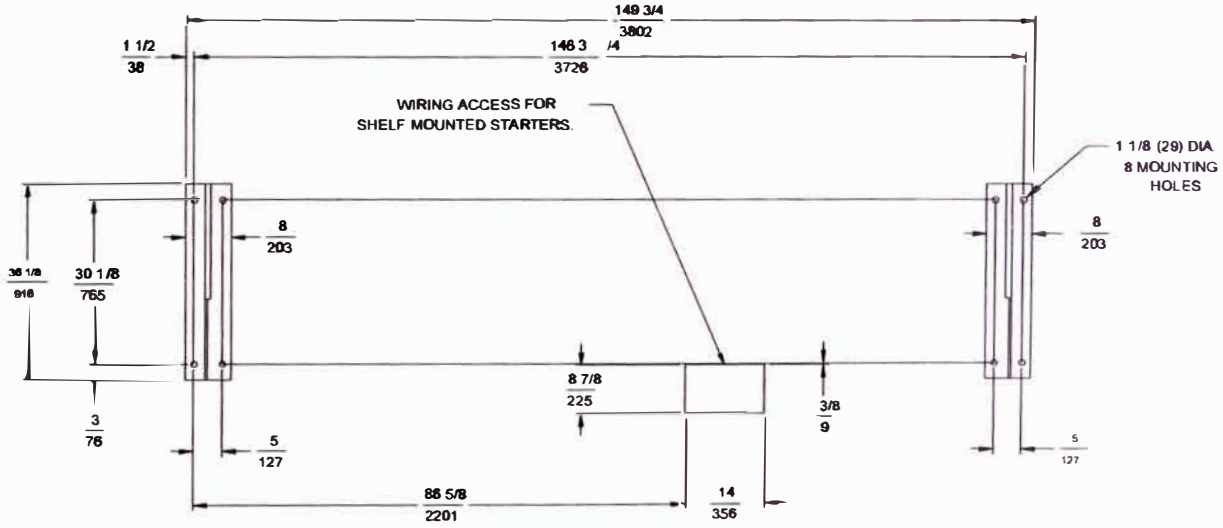
Center of Gravity with Starter			
X	Y	Z	see note 12
79 3/8 (2016)	35 1/2 (902)	13 7/8 (353)	Oper.
79 5/8 (2023)	34 5/8 (880)	14 (356)	Ship

See Notes on Next Page.

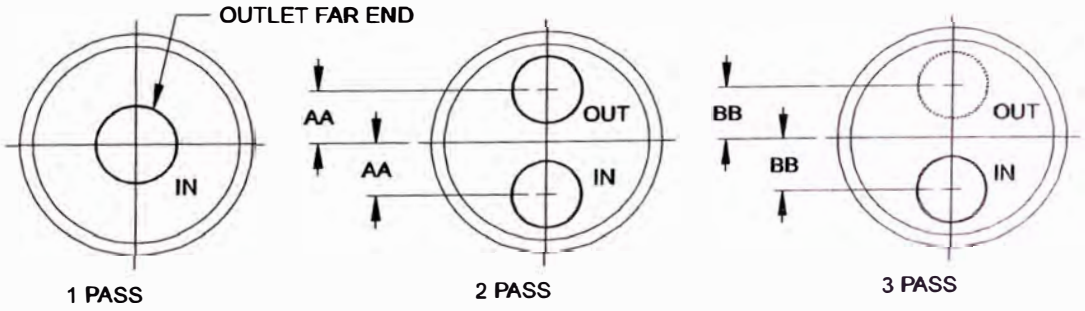
Notes for Figure 25

1. One half inch (13) FPT evaporator and condenser relief valves must be piped per ANSI/ASHRAE 15. (1 for each evaporator, 2 for each condenser).
2. 168 inches (4267) is required at either end of the tubesheet for tube replacement. 36 inches (914) is recommended on all other sides and top for service clearance.
3. Final connections must allow for manufacturing tolerance.
4. Standard heads are shown. For dimensions of high pressure construction, water boxes, or flange type connections, contact your representative.
5. For dimensions of different condenser or evaporator pass see table.
6. Unit is shipped with an operating charge of refrigerant and oil.
7. Six 2 1/2 inch (64) dia. Lifting holes are provided.
8. All water connections are given in standard U.S. Pipe sizes. Standard connections are suitable for welding or victualic couplings.
9. Vibration isolator pads are provided for field installation 0.25 inches (6) thick when loaded.
10. f main power wiring is brought up through the floor, this wiring must be outside the envelope of the unit.
11. Pumpdown capacity is determined in accordance with ANSI/ASHRAE 15 for the maximum tube count.
12. These values are for units with standard wall thickness copper tubing only.
13. The shipping skid adds 4 inches (102) to the overall unit height.

Figure 25, Standard shell dimensions R-22 Refrigerant (continued)



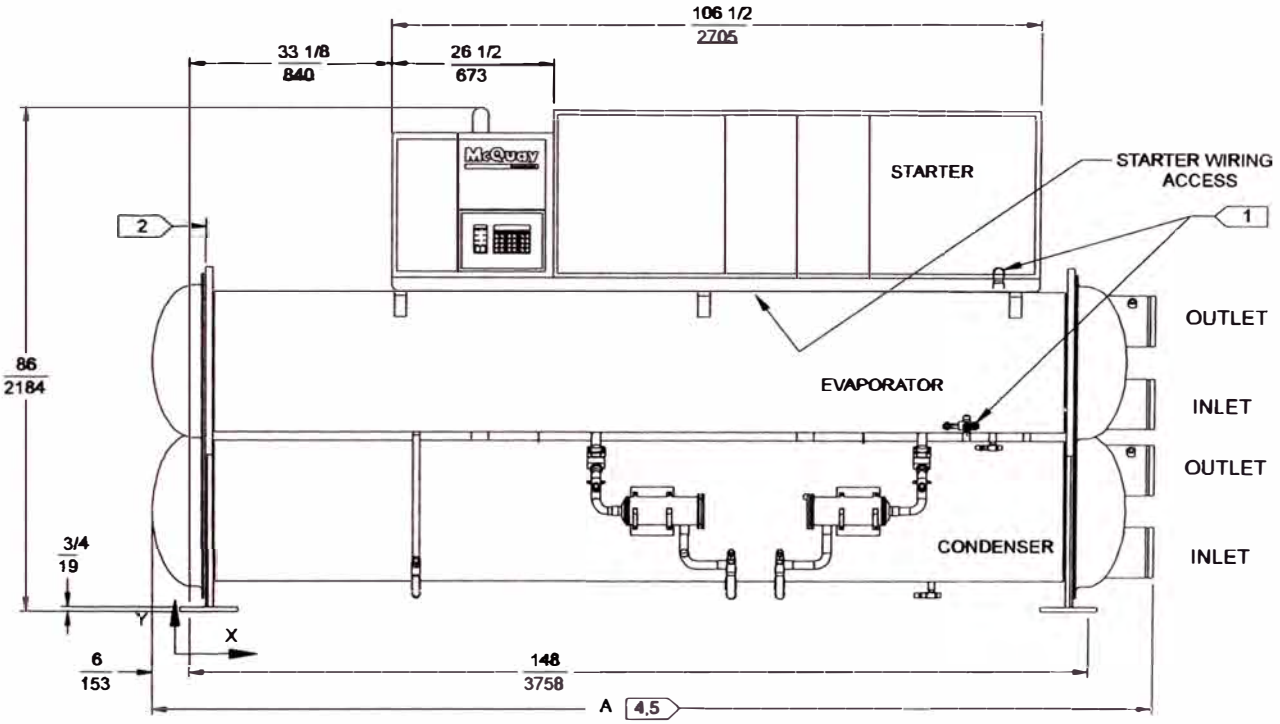
NOZZLE SIZES AND LOCATIONS
DIMENSIONS In INCHES (MM)

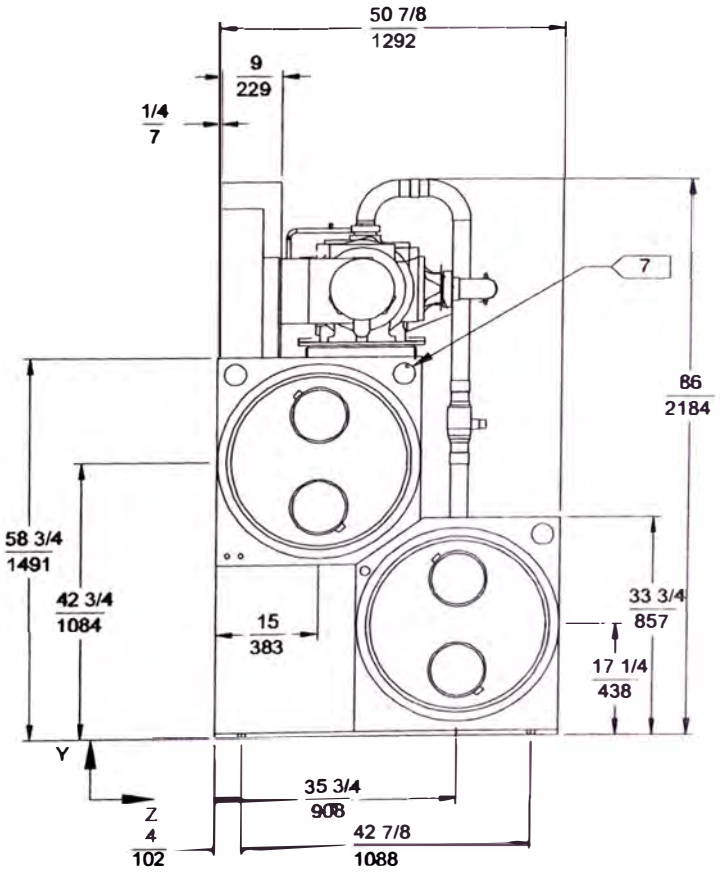


1 PASS 2 PASS 3 PASS

Vessel Code		Head Connection U.S. Pipe Size			AA	BB
Evap.	Cond.	1P	2P	3P		
E1812		8	6	5	4 7/8 (124)	4 7/8 (124)
	C1812	8	6	5	4 7/8 (124)	4 7/8 (124)

Figure 26, Long shell dimemsions R-22 Refrigerant Models 155-190





All dimensions are shown in inches and (mm)

Overall Length A			Overall Height (Note 13)	Overall Width With Starter
1 & 3 Pass	2 & 4 Pass Head Conn on same end	2 & 4 Pass Head Conn. both ends		
169 1/4 (4299)	164 5/8 (4181)	169 1/4 (4299)	86 (2184)	50 7/8 (1292)

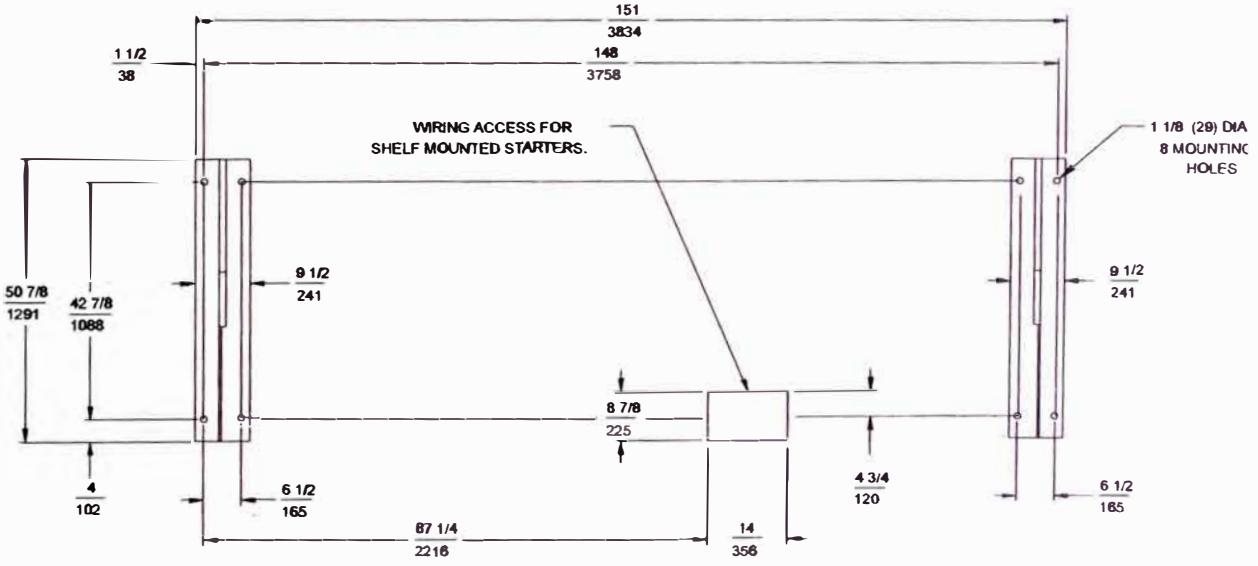
Center of Gravity with Starter			
X	Y	Z	see note 12
77 3/4 (2473)	38 1/4 (899)	20 3/8 (362)	Oper.
78 1/4 (1988)	37 7/8 (962)	20 3/8 (518)	Ship

See Notes on Next Page.

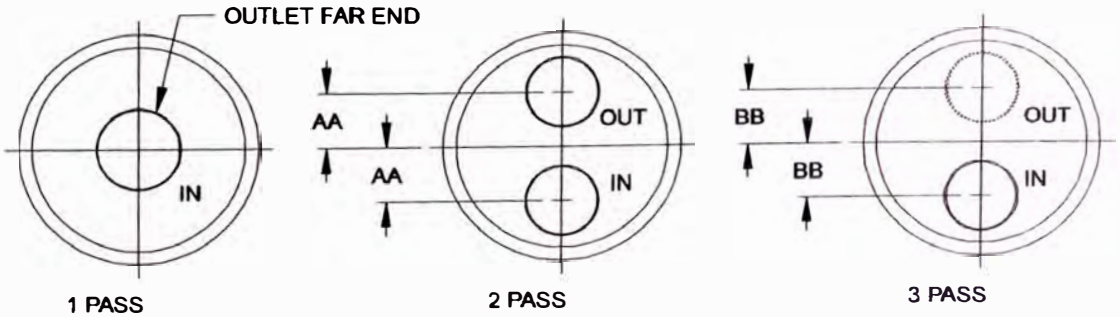
Notes for Figure 26

1. One half inch (13) FPT evaporator and condenser relief valves must be piped per ANSI/ASHRAE 15. (1 for each evaporator, 2 for each condenser).
2. 168 inches (4267) is required at either end of the tubesheet for tube replacement. 36 inches (914) is recommended on all other sides and top for service clearance.
3. Final connections must allow for manufacturing tolerance.
4. Standard heads are shown. For dimensions of high pressure construction, water boxes, or flange type connections, contact your representative.
5. For dimensions of different condenser or evaporator pass see table
6. Unit is shipped with an operating charge of refrigerant and oil.
7. Six 2 1/2 inch (64) dia. Lifting holes are provided.
8. All water connections are given in standard U.S. Pipe sizes. Standard connections are suitable for welding or victualic couplings.
9. Vibration isolator pads are provided for field installation 0.25 inches (6) thick when loaded.
10. f main power wiring is brought up through the floor, this wiring must be outside the envelope of the unit.
11. Pumpdown capacity is determined in accordance with ANSI/ASHRAE 15 for the maximum tube count.
12. These values are for units with standard wall thickness copper tubing only.
13. The shipping skid adds 4 inches (102) to the overall unit height.

Figure 26, Long shell dimensions R-22 Refrigerant Models 155-190(continued)



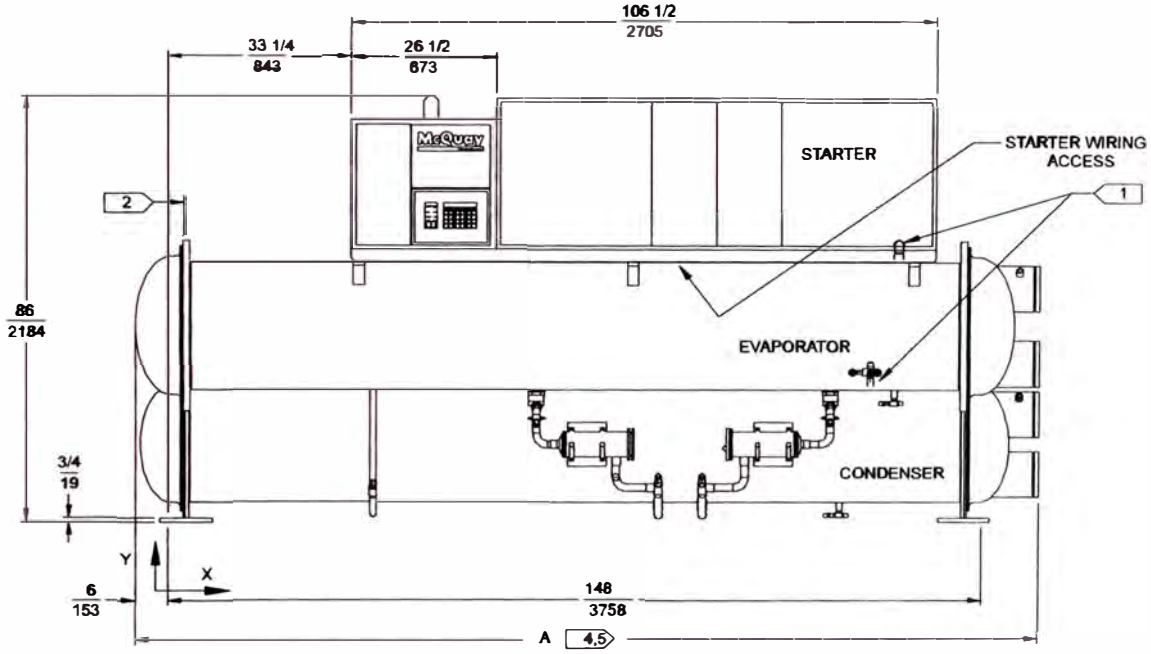
NOZZLE SIZES AND LOCATIONS
DIMENSIONS In INCHES (MM)



1 PASS 2 PASS 3 PASS

Vessel Code		Head Connection U.S. Pipe Size			AA	BB
Evap.	Cond.	1P	2P	3P		
E2412		10	8	8	7 1/8 (181)	7 1/8 (181)
	C2412	10	8	8	7 1/8 (181)	7 1/8 (181)

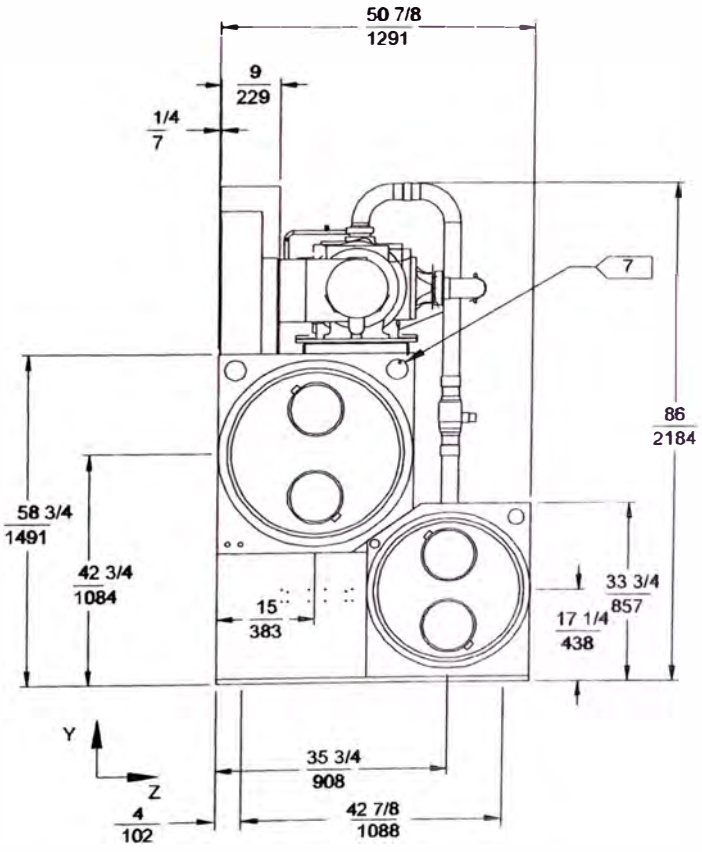
Figure 27, Long shell dimemsions R-22 Refrigerant Models 200-210



All dimensions are shown in inches and (mm)

Overall Length A			Overall Height (Note 13)	Overall Width With Starter
1 & 3 Pass	2 & 4 Pass Head Conn on same end	2 & 4 Pass Head Conn. both ends		
169 1/4 (4299)	164 5/8 (4181)	169 1/4 (4299)	86 (2184)	50 7/8 (1292)

Center of Gravity with Starter			
X	Y	Z	see note 12
78 1/8 (1984)	39 1/2 (1003)	20 3/4 (527)	Oper.
78 1/2 (1994)	38 7/8 (987)	20 3/4 (527)	Ship

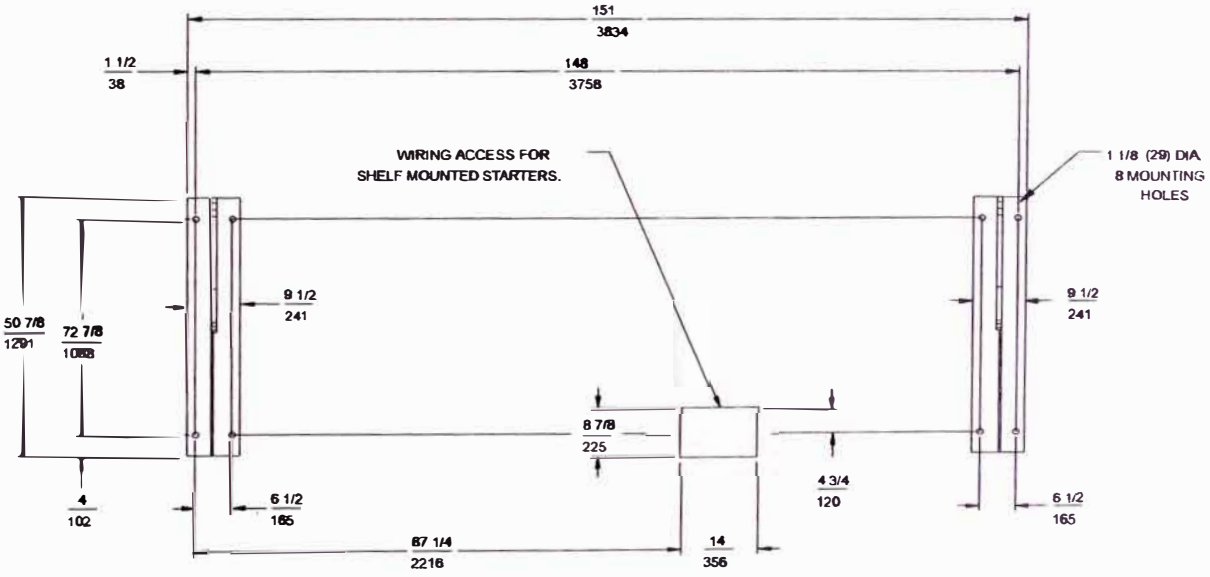


See Notes on Next Page.

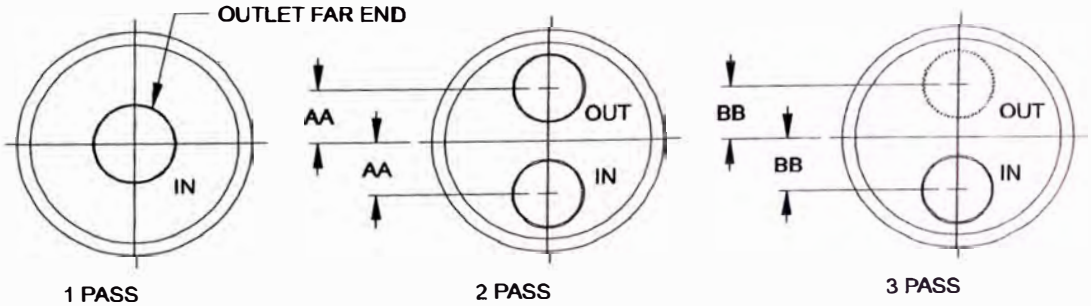
Notes for Figure 27

1. One Half inch (13) FPT evaporator and condenser relief valves must be piped per ANSI/ASHRAE 15. (1 for each evaporator, 2 for each condenser).
2. 168 inches (4267) is required at either end of the tubesheet for tube replacement. 36 inches (914) is recommended on all other sides and top for service clearance.
3. Final connections must allow for manufacturing tolerance.
4. Standard heads are shown. For dimensions of high pressure construction, water boxes, or flange type connections, contact your representative.
5. For dimensions of different condenser or evaporator pass see table
6. Unit is shipped with an operating charge of refrigerant and oil.
7. Six 2 1/2 inch (64) dia. Lifting holes are provided.
8. All water connections are given in standard U.S. Pipe sizes. Standard connections are suitable for welding or victualic couplings.
9. Vibration isolator pads are provided for field installation 0.25 inches (6) thick when loaded.
10. If main power wiring is brought up through the floor, this wiring must be outside the envelope of the unit.
11. Pumpdown capacity is determined in accordance with ANSI/ASHRAE 15 for the maximum tube count.
12. These values are for units with standard wall thickness copper tubing only.
13. The shipping skid adds 4 inches (102) to the overall unit height.

Figure 27, Long shell dimensions R-22 Refrigerant Models 200-210(continued)



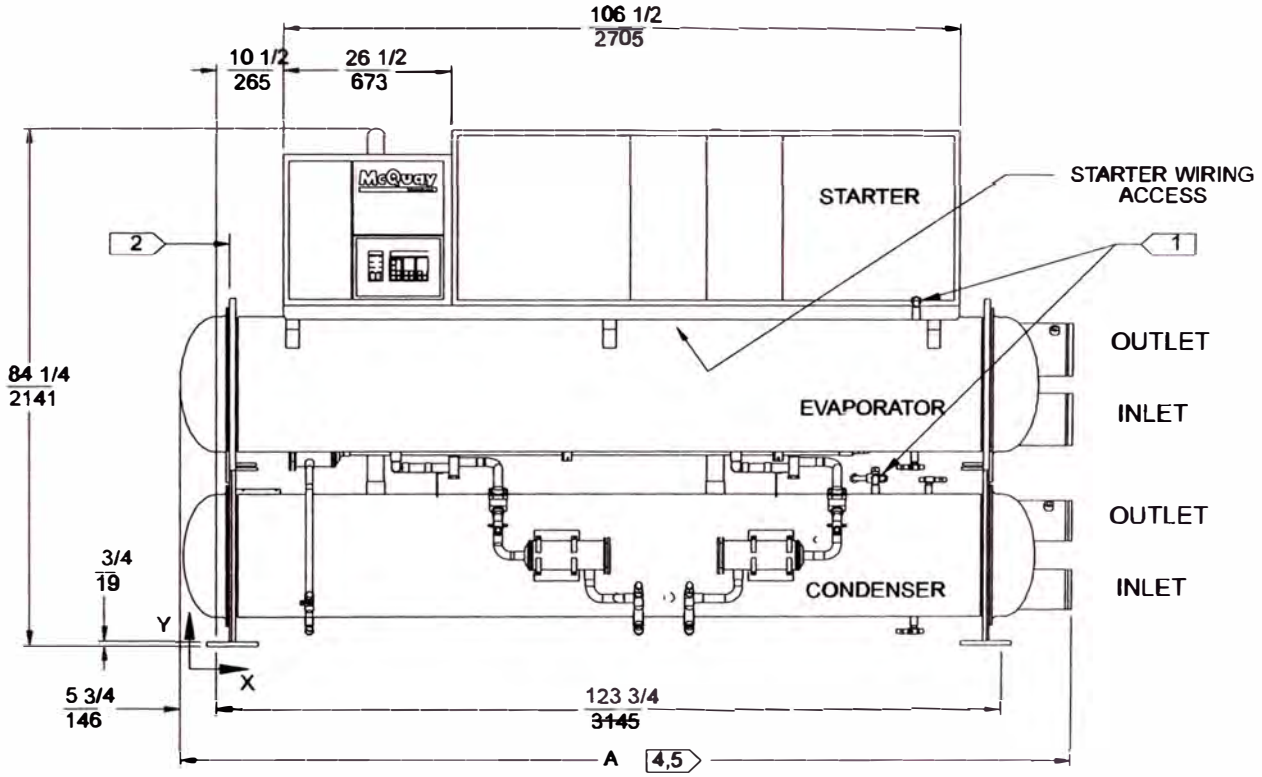
NOZZLE SIZES AND LOCATIONS
DIMENSIONS In INCHES (MM)



1 PASS 2 PASS 3 PASS

Vessel Code		Head Connection U.S. Pipe Size			AA	BB
Evap.	Cond.	1P	2P	3P		
E2412		10	8	8	7 1/8 (181)	7 1/8 (181)
	C2212	10	8	6	5 3/4 (146)	6 3/8 (162)

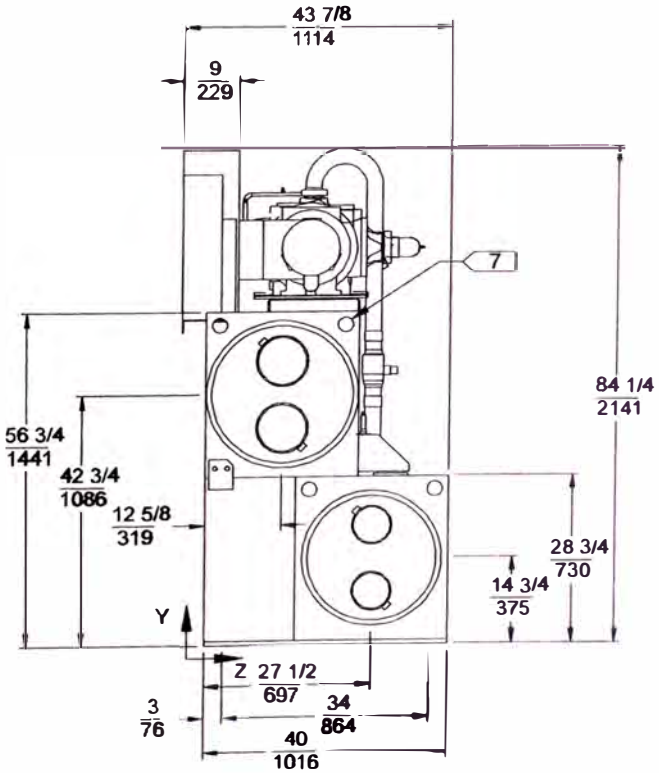
Figure 28, Short shell dimemsions R-410A Refrigerant



All dimensions are shown in inches and (mm)

Overall Length A			Overall Height (Note 13)	Overall Width With Starter
1 & 3 Pass	2 & 4 Pass Head Conn on same end	2 & 4 Pass Head Conn. both ends		
146 1/4 (3715)	140 3/4 (3577)	146 3/4 (3715)	84 3/4 (2141)	43 7/8 (1114)

Center of Gravity with Starter			
X	Y	Z	see note 12
64 5/8 (1642)	40 1016)	15 1/4 (387)	Oper.
64 5/8 (1642)	39 (991)	15 3/8 (391)	Ship

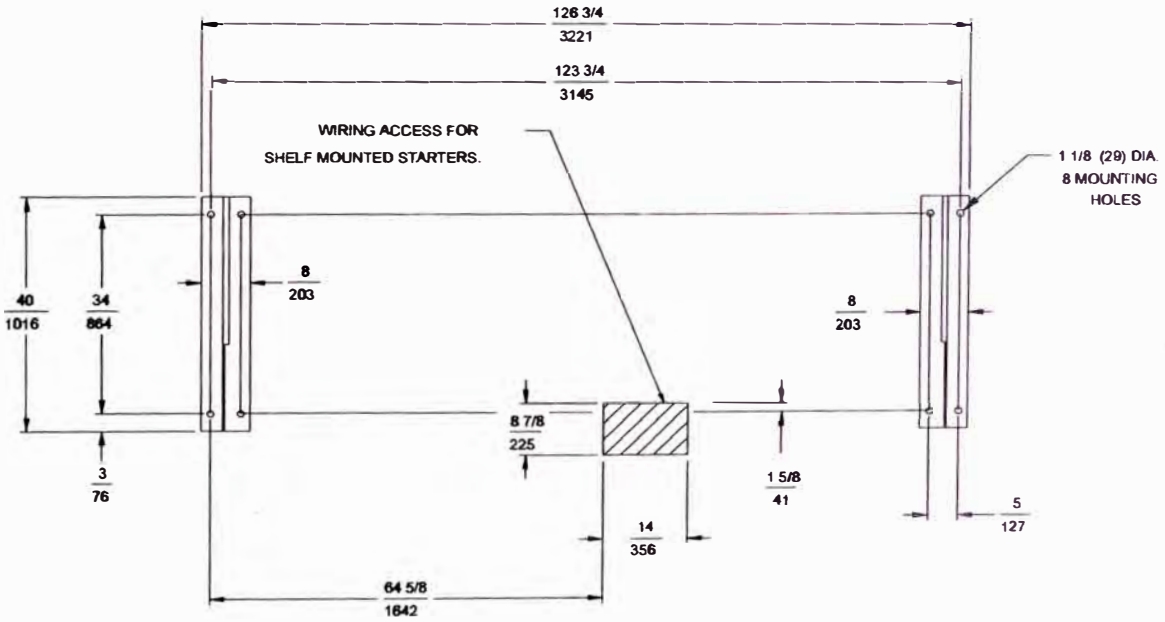


See Notes on Next Page.

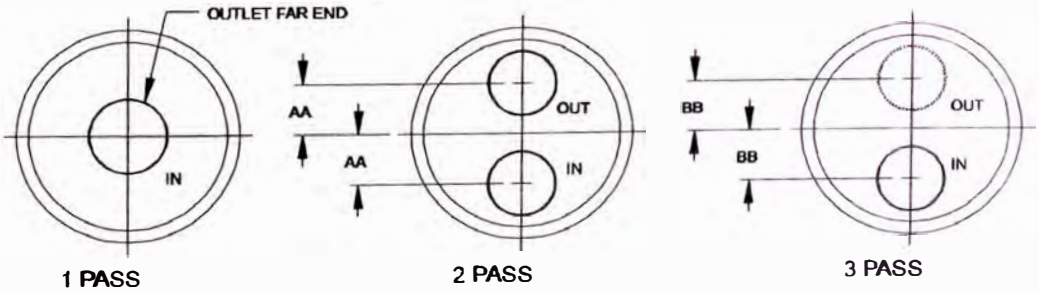
Notes for Figure 28

1. one half inch (13) FPT evaporator and condenser relief valves must be piped per ANSI/ASHRAE 15. (1 for each evaporator, 2 for each condenser).
2. 144 inches (3658) is required at either end of the tubesheet for tube replacement. 36 inches (914) is recommended on all other sides and top for service clearance.
3. Final connections must allow for manufacturing tolerance.
4. Standard heads are shown. For dimensions of high pressure construction, water boxes, or flange type connections, contact your representative.
5. For dimensions of different condenser or evaporator pass see table
6. Unit is shipped with an operating charge of refrigerant and oil.
7. Six 2 1/2 inch (64) dia. Lifting holes are provided.
8. All water connections are given in standard U.S. Pipe sizes. Standard connections are suitable for welding or victualic couplings.
9. Vibration isolator pads are provided for field installation 0.25 inches (6) thick when loaded.
10. f main power wiring is brought up through the floor, this wiring must be outside the envelope of the unit.
11. Pumpdown capacity is determined in accordance with ANSI/ASHRAE 15 for the maximum tube count.
12. These values are for units with standard wall thickness copper tubing only.
13. The shipping skid adds 4 inches (102) to the overall unit height.

Figure 28, Short shell dimensions R-410A Refrigerant (continued)



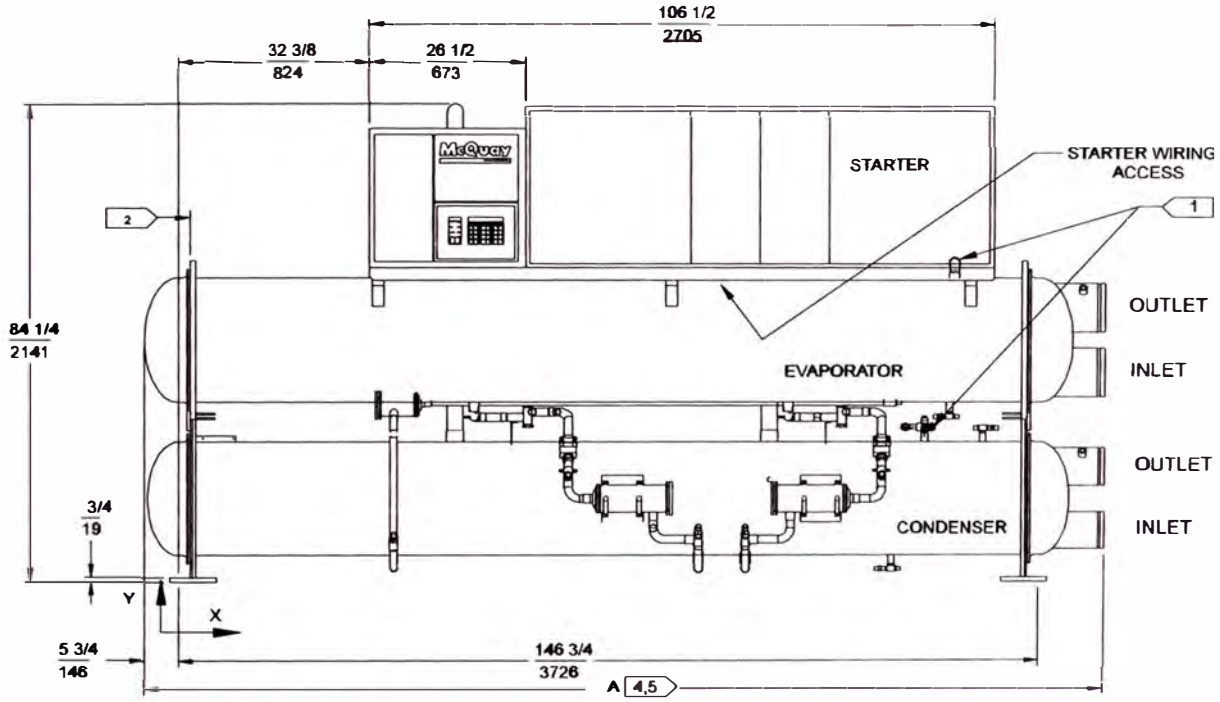
NOZZLE SIZES AND LOCATIONS
DIMENSIONS In INCHES (MM)

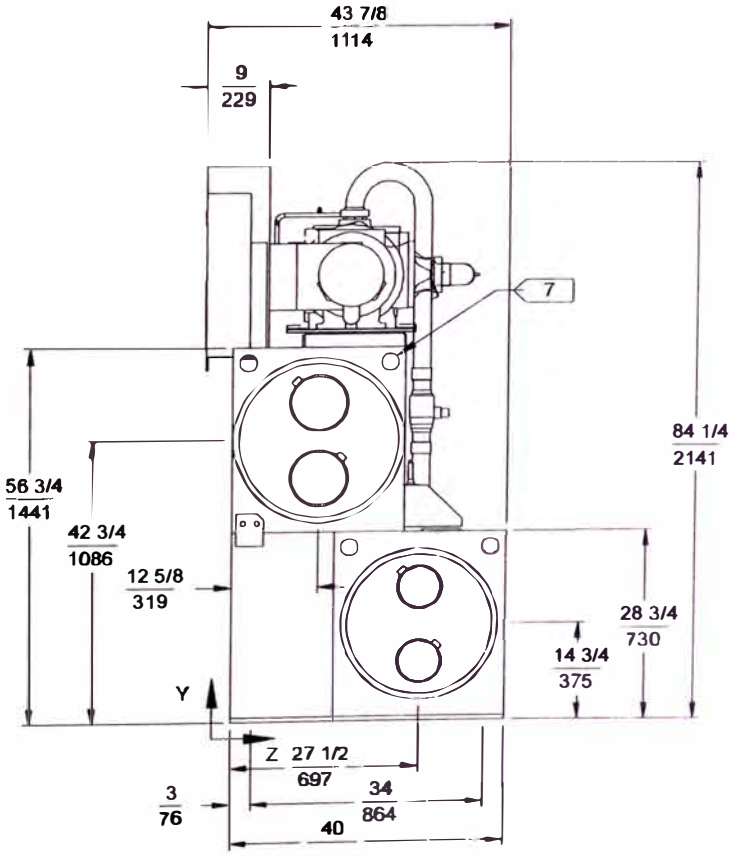


1 PASS 2 PASS 3 PASS

Vessel Code		Head Connection U.S. Pipe Size			AA	BB
Evap.	Cond.	1P	2P	3P		
E2212		10	8	6	5 3/4 (145)	6 3/8 (161)
	C2012	10	8	5	5 5/8 (143)	6 3/16 (157)

Figure 29, Standard shell dimemsions R-410A Refrigerant





All dimensions are shown in inches and (mm)

Overall Length A			Overall Height (Note 13)	Overall Width With Starter
1 & 3 Pass	2 & 4 Pass Head Conn on same end	2 & 4 Pass Head Conn. both ends		
169 1/4 (4299)	163 3/4 (4159)	169 1/4 (4299)	84 1/4 (2141)	47 7/8 (1114)

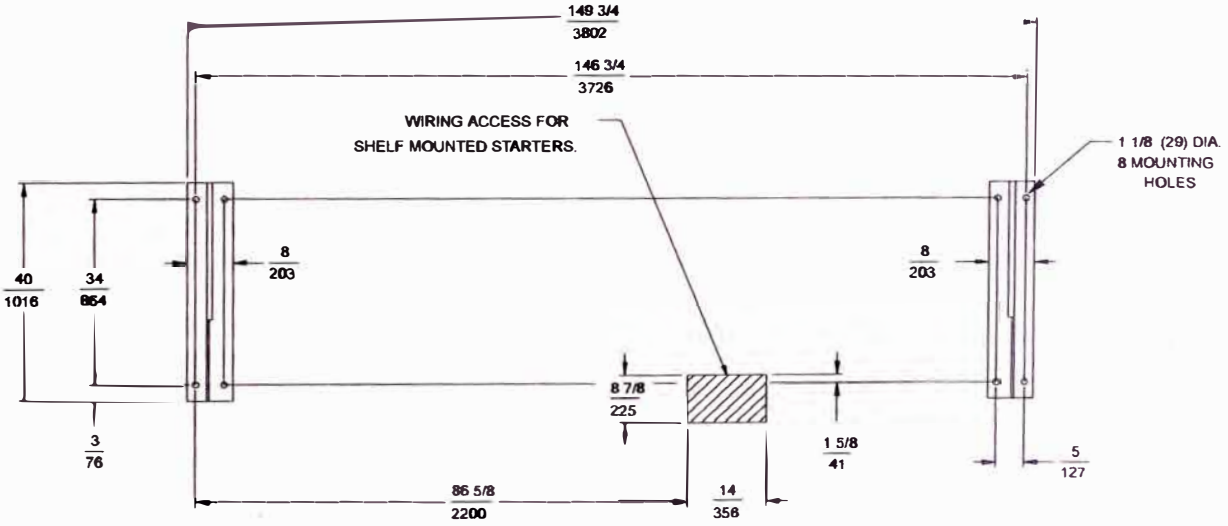
Center of Gravity with Starter			
X	Y	Z	see note 12
78 3/8 (1991)	38 1/2 (978)	15 1/2 (394)	Oper.
78 5/8 (1997)	37 7/8 (962)	15 5/8 (397)	Ship

See Notes on Next Page.

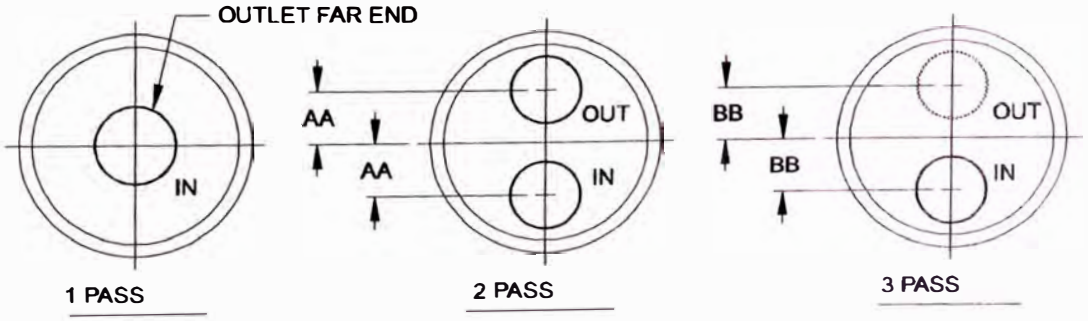
Notes for Figure 29

1. one half inch (13) FPT evaporator and condenser relief valves must be piped per ANSI/ASHRAE 15. (1 for each evaporator, 2 for each condenser).
2. 168 inches (4267) is required at either end of the tubesheet for tube replacement. 36 inches (914) is recommended on all other sides and top for service clearance.
3. Final connections must allow for manufacturing tolerance.
4. Standard heads are shown. For dimensions of high pressure construction, water boxes, or flange type connections, contact your representative.
5. For dimensions of different condenser or evaporator pass see table
6. Unit is shipped with an operating charge of refrigerant and oil.
7. Six 2 1/2 inch (64) dia. Lifting holes are provided.
8. All water connections are given in standard U.S. Pipe sizes. Standard connections are suitable for welding or victualic couplings.
9. Vibration isolator pads are provided for field installation 0.25 inches (6) thick when loaded.
10. f main power wiring is brought up through the floor, this wiring must be outside the envelope of the unit.
11. Pumpdown capacity is determined in accordance with ANSI/ASHRAE 15 for the maximum tube count.
12. These values are for units with standard wall thickness copper tubing only.
13. The shipping skid adds 4 inches (102) to the overall unit height.

Figure 29, Standard shell dimensions R-410A Refrigerant (continued)

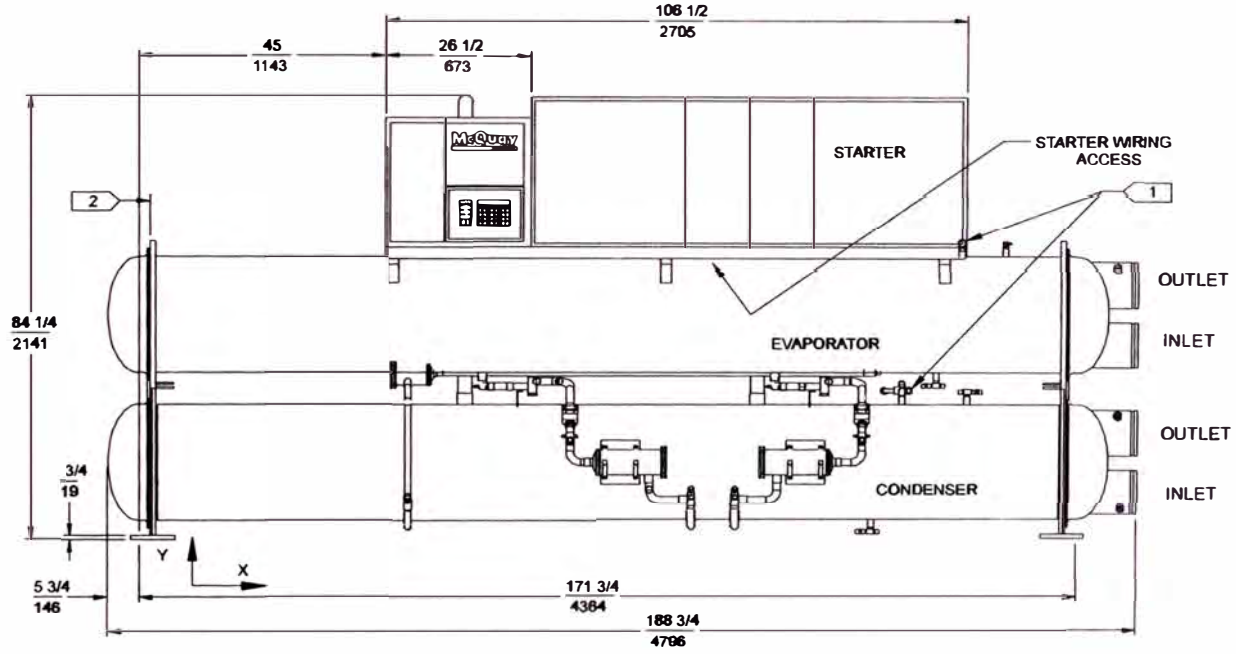


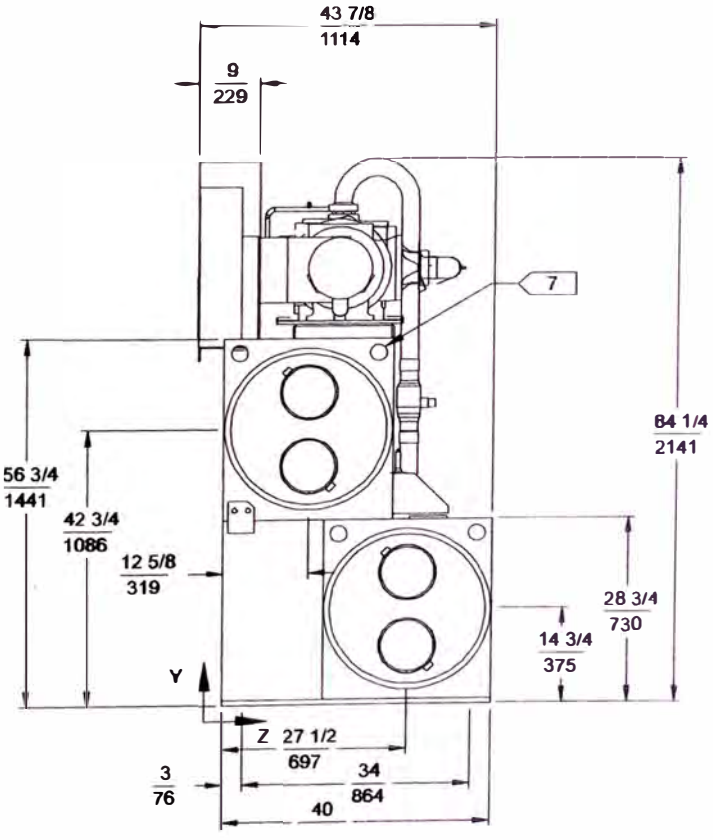
NOZZLE SIZES AND LOCATIONS
DIMENSIONS In INCHES (MM)



Vessel Code		Head Connection U.S. Pipe Size			AA	BB
Evap.	Cond.	1P	2P	3P		
E2212		10	8	6	5 3/4 (145)	6 3/8 (161)
	C2012	8	6	5	5 5/8 (143)	6 3/16 (157)

Figure 30, Long shell dimemsions R-410A Refrigerant





All dimensions are shown in inches and (mm)

Overall Length A			Overall Height (Note 13)	Overall Width With Starter
1 & 3 Pass	2 & 4 Pass Head Conn on same end	2 & 4 Pass Head Conn. both ends		
194 1/4 (4934)	188 3/4 (4794)	194 1/4 (4934)	84 1/4 (2141)	43 7/8 (1114)

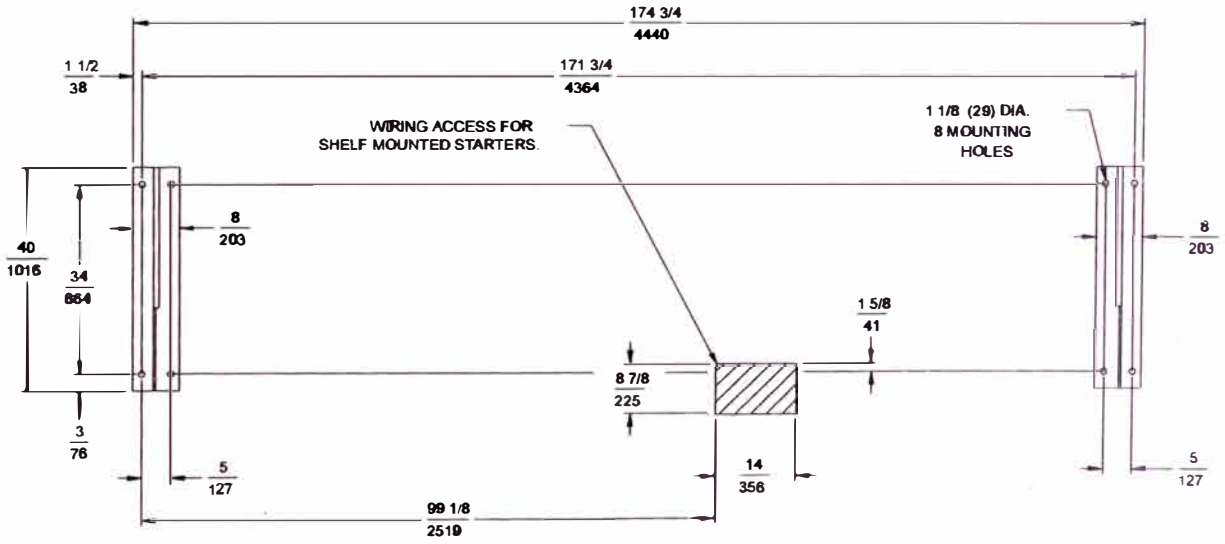
Center of Gravity with Starter			
X	Y	Z	see note 12
90 1/8 (2289)	36 3/8 (924)	16 1/4 (413)	Oper.
90 1/2 (2299)	35 3/4 (908)	16 1/4 (413)	Ship

See Notes on Next Page.

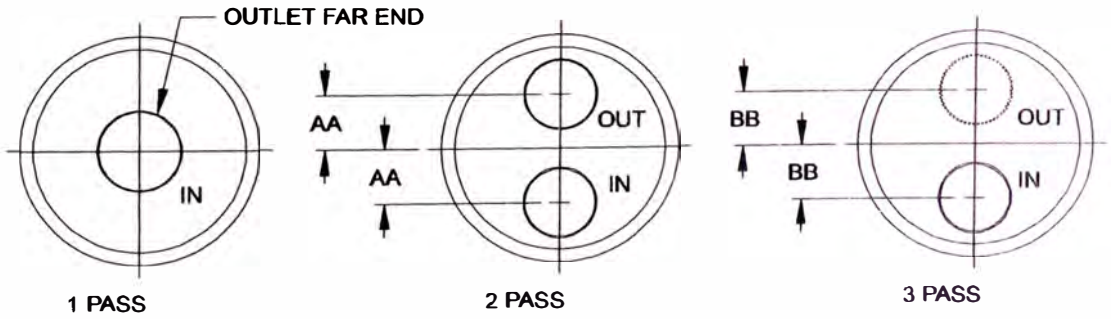
Notes for Figure 30

1. one half inch (13) FPT evaporator and condenser relief valves must be piped per ANSI/ASHRAE 15. (1 for each evaporator, 2 for each condenser).
2. 192 inches (4877) is required at either end of the tubesheet for tube replacement. 36 inches (914) is recommended on all other sides and top for service clearance.
3. Final connections must allow for manufacturing tolerance.
4. Standard heads are shown. For dimensions of high pressure construction, water boxes, or flange type connections, contact your representative.
5. For dimensions of different condenser or evaporator pass see table
6. Unit is shipped with an operating charge of refrigerant and oil.
7. Six 2 1/2 inch (64) dia. Lifting holes are provided.
8. All water connections are given in standard U.S. Pipe sizes. Standard connections are suitable for welding or victualic couplings.
9. Vibration isolator pads are provided for field installation 0.25 inches (6) thick when loaded.
10. f main power wiring is brought up through the floor, this wiring must be outside the envelope of the unit.
11. Pumpdown capacity is determined in accordance with ANSI/ASHRAE 15 for the maximum tube count.
12. These values are for units with standard wall thickness copper tubing only.
13. The shipping skid adds 4 inches (102) to the overall unit height.

Figure 30, Long shell dimensions R-410A Refrigerant (continued)



NOZZLE SIZES AND LOCATIONS
DIMENSIONS In INCHES (MM)



Vessel Code		Head Connection U.S. Pipe Size			AA	BB
Evap.	Cond.	1P	2P	3P		
E2214		10	8	6	5 3/4 (145)	6 3/8 (161)
	C2214	10	8	6	5 3/4 (146)	6 3/8 (162)

CAUTION

PFS unit compressors are single direction rotation compressors. For this reason proper phasing of electrical power is essential. Electrical phasing must be A, B, C clockwise for electrical phases 1, 2 and 3 (A=L1 ,B=L2,C=L3). The unit is supplied with single point factory power connection and includes one MotorSaver phase failure, phase reversal protective device that will prevent operation of the unit with incorrect power phasing. The MotorSaver is factory wired and tested. Do not alter the wiring to the MotorSaver.

General Information

Wiring must comply with all applicable codes and ordinances. Warranty is void if wiring is not in accordance with specifications.

Copper wire must be used for all wiring.

The PFS is typically supplied with the main power wiring for single point power connection. A single large power terminal block is provided for field connections. Wiring within the unit is sized according to the National Electrical Code. A single field-mounted disconnect (supplied by others) is required. An optional factory mounted transformer for the 115 volt control circuit may have been provided.

Main power must enter the control panel at the location indicated on the unit illustration.

Table 9, Compressor amp draw

PFS Unit Size	Volts	Hz	Rated Load Amps Compressor		Locked Rotor Amps Compressor Delta-Delta Start	
			Comp. 1	Comp. 2	Comp. 1	Comp. 2
155C	208	60	179	179	934	934
	230		162	162	1042	1042
	380		98	98	604	604
	460		81	81	489	489
	575		65	65	377	377
170C	208	60	179	223	934	934
	230		162	202	1042	1042
	380		98	122	604	604
	460		81	101	489	489
	575		65	81	377	377
180C	208	60	179	254	934	934
	230		162	230	1042	1042
	380		98	139	604	604
	460		81	115	489	489
	575		65	92	377	377
190C	208	60	223	223	934	934
	230		202	202	1042	1042
	380		122	122	604	604
	460		101	101	489	489
	575		81	81	377	377
200B	208	60	223	254	934	934
	230		202	230	1042	1042
	380		122	139	604	604
	460		101	115	489	489
	575		81	92	377	377
210C	208	60	254	254	934	934
	230		230	230	1042	1042
	380		139	139	604	604
	460		115	115	489	489
	575		92	92	377	377

NOTES:

1. Allowable voltage is within ±10 % of nameplate rating.

2. Compressor RLA values are for wiring sizing only. They do not reflect normal operating current draw at unit rated capacity.

Table 10, Compressor Amp Draw

PFS Unit Size	Volts	Hz	Rated Load Amps Compressor		Locked Rotor Amps Compressor Delta-Delta Start	
			Comp. 1	Comp. 2	Comp. 1	Comp. 2
235C	208	60	286	286	934	934
	230		259	259	1042	1042
	380		157	157	604	604
	460		130	130	489	489
	575		104	104	377	377
255C	208	60	286	357	934	934
	230		259	323	1042	1042
	380		157	195	604	604
	460		130	162	489	489
	575		104	130	377	377
270C	208	60	286	406	934	934
	230		259	368	1042	1042
	380		157	222	604	604
	460		130	184	489	489
	575		104	147	377	377
280C	208	60	357	357	934	934
	230		323	323	1042	1042
	380		195	195	604	604
	460		162	162	489	489
	575		130	130	377	377
300C	208	60	357	406	934	934
	230		323	368	1042	1042
	380		195	222	604	604
	460		162	184	489	489
	575		130	147	377	377
315C	208	60	406	406	934	934
	230		368	368	1042	1042
	380		222	222	604	604
	460		184	184	489	489
	575		147	147	377	377

NOTES:

1. Allowable voltage limit is within ±10 percent of nameplate rating.
2. Compressor RLA values are for wire sizing only. They do not reflect normal operating current draw at unit rated capacity.

Table 11, Customer wiring information

PFS Unit Size	Volts	Hz	Wiring to unit Power Block		Wiring to Disconnect Switch	
			Power Block		Optional Disconnect Switch	
			Terminal Size Amps	Connector Wire Range (per phase) (Copper Wire Only)	Size	Connector Wire Range (per phase) (Copper Wire Only)
155C	208	60	665	(1) #6-350 MCM & (1) #4-500 MCM	600	(2) 250-350 MCM
	230		665	(1) #6-350 MCM & (1) #4-500 MCM	400	(2) 3/0-250 MCM
	380		335	(1) #6-400 MCM	250	(1) #4-350 MCM
	460		335	(1) #6-400 MCM	250	(1) #4-350 MCM
	575		335	(1) #6-400 MCM	250	(1) #4-350 MCM
170C	208	60	665	(1) #6-350 MCM & (1) #4-500 MCM	600	(2) 250-350 MCM
	230		665	(1) #6-350 MCM & (1) #4-500 MCM	600	(2) 250-350 MCM
	380		335	(1) #6-400 MCM	400	(2) 3/0-250 MCM
	460		335	(1) #6-400 MCM	250	(1) #4-350 MCM
	575		335	(1) #6-400 MCM	250	(1) #4-350 MCM
180C	208	60	665	(1) #6-350 MCM & (1) #4-500 MCM	600	(2) 250-350 MCM
	230		665	(1) #6-350 MCM & (1) #4-500 MCM	600	(2) 250-350 MCM
	380		335	(1) #6-400 MCM	400	(1) 2/0-500 MCM
	460		335	(1) #6-400 MCM	250	(1) #4-350 MCM
	575		335	(1) #6-400 MCM	250	(1) #4-350 MCM
190C	208	60	665	(1) #6-350 MCM & (1) #4-500 MCM	600	(2) 250-350 MCM
	230		665	(1) #6-350 MCM & (1) #4-500 MCM	600	(2) 250-350 MCM
	380		335	(1) #6-400 MCM	400	(1) 2/0-500 MCM
	460		335	(1) #6-400 MCM	250	(1) #4-350 MCM
	575		335	(1) #6-400 MCM	250	(1) #4-350 MCM
200C	208	60	665	(1) #6-350 MCM & (1) #4-500 MCM	600	(2) 250-350 MCM
	230		665	(1) #6-350 MCM & (1) #4-500 MCM	600	(2) 250-350 MCM
	380		335	(1) #6-400 MCM	400	(1) 2/0-500 MCM
	460		335	(1) #6-400 MCM	250	(1) #4-350 MCM
	575		335	(1) #6-400 MCM	250	(1) #4-350 MCM
210C	208	60	665	(1) #6-350 MCM & (1) #4-500 MCM	600	(2) 250-350 MCM
	230		665	(1) #6-350 MCM & (1) #4-500 MCM	600	(2) 250-350 MCM
	380		335	(1) #6-400 MCM	400	(1) 2/0-500 MCM
	460		335	(1) #6-400 MCM	400	(1) 2/0-500 MCM
	575		335	(1) #6-400 MCM	250	(1) #4-350 MCM

Note:
Allowable voltage is within ±10 percent of nameplate rating.

Table 12, Customer Wiring Information

PFS Unit Size	Volts	Hz	Wiring to unit Power Block		Wiring to Main Circuit Breaker	
			Power Block		Optional Main Circuit Breaker	
			Terminal Size Amps Ckt.1 / Ckt.2	Connector Wire Range (per phase) (Copper Wire Only) Ckt.1 / Ckt.2	Size Ckt.1 / Ckt.2	Connector Wire Range (per phase) (Copper Wire Only) Ckt.1 / Ckt.2
235C	208	60	665 / 665	(1) # 6-350 MCM & (1) # 4-500 MCM & (1) # 6-350 MCM & (1) # 4-500 MCM	NA	NA
	230		665 / 665	(1) # 6-350 MCM & (1) # 4-500 MCM & (1) # 6-350 MCM & (1) # 4-500 MCM	NA	NA
	380		665	(1) # 6-350 MCM & (1) # 4-500 MCM	400	(2) 3/0-250 MCM
	460		335	(1) # 6-400 MCM	400	(1) 2/0-500 MCM
	575		335	(1) # 6-400 MCM	250	(1) #4-350 MCM
255C	208	60	665 / 665	(1) # 6-350 MCM & (1) # 4-500 MCM & (1) # 6-350 MCM & (1) # 4-500 MCM	NA	NA
	230		665 / 665	(1) # 6-350 MCM & (1) # 4-500 MCM & (1) # 6-350 MCM & (1) # 4-500 MCM	NA	NA
	380		665	(1) # 6-350 MCM & (1) # 4-500 MCM	600	(2) 250-350 MCM
	460		665	(1) # 6-350 MCM & (1) # 4-500 MCM	400	(1) 2/0-500 MCM
	575		335	(1) # 6-400 MCM	400	(1) 2/0-500 MCM
270C	208	60	665 / 665	(1) # 6-350 MCM & (1) # 4-500 MCM & (1) # 6-350 MCM & (1) # 4-500 MCM	NA	NA
	230		665 / 665	(1) # 6-350 MCM & (1) # 4-500 MCM & (1) # 6-350 MCM & (1) # 4-500 MCM	NA	NA
	380		665	(1) # 6-350 MCM & (1) # 4-500 MCM	600	(2) 250-350 MCM
	460		665	(1) # 6-350 MCM & (1) # 4-500 MCM	400	(1) 2/0-500 MCM
	575		665	(1) # 6-350 MCM & (1) # 4-500 MCM	400	(1) 2/0-500 MCM
280C	208	60	665 / 665	(1) # 6-350 MCM & (1) # 4-500 MCM & (1) # 6-350 MCM & (1) # 4-500 MCM	NA	NA
	230		665 / 665	(1) # 6-350 MCM & (1) # 4-500 MCM & (1) # 6-350 MCM & (1) # 4-500 MCM	NA	NA
	380		665	(1) # 6-350 MCM & (1) # 4-500 MCM	600	(2) 250-350 MCM
	460		665	(1) # 6-350 MCM & (1) # 4-500 MCM	400	(1) 2/0-500 MCM
	575		335	(1) # 6-400 MCM	400	(1) 2/0-500 MCM
300C	208	60	665 / 665	(1) # 6-350 MCM & (1) # 4-500 MCM & (1) # 6-350 MCM & (1) # 4-500 MCM	NA	NA
	230		665 / 665	(1) # 6-350 MCM & (1) # 4-500 MCM & (1) # 6-350 MCM & (1) # 4-500 MCM	NA	NA
	380		665	(1) # 6-350 MCM & (1) # 4-500 MCM	600	(2) 250-350 MCM
	460		665	(1) # 6-350 MCM & (1) # 4-500 MCM	400	(2) 3/0-250 MCM
	575		665	(1) # 6-350 MCM & (1) # 4-500 MCM	400	(1) 2/0-500 MCM
315C	208	60	665 / 665	(1) # 6-350 MCM & (1) # 4-500 MCM & (1) # 6-350 MCM & (1) # 4-500 MCM	NA	NA
	230		665 / 665	(1) # 6-350 MCM & (1) # 4-500 MCM & (1) # 6-350 MCM & (1) # 4-500 MCM	NA	NA
	380		665	(1) # 6-350 MCM & (1) # 4-500 MCM	600	(2) 250-350 MCM
	460		665	(1) # 6-350 MCM & (1) # 4-500 MCM	600	(2) 250-350 MCM
	575		665	(1) # 6-350 MCM & (1) # 4-500 MCM	400	(1) 2/0-500 MCM

NOTE:
Allowable voltage is within ±10 percent of nameplate rating

Table 13, Electrical data

PFS Unit Size	Volts	Hz	Minimum Circuit Ampacity (MCA)	Power Supply Field Wire		Field Fuse Size	
				Qty. (3)	Wire Gauge	Recom-mended	Maximum
155C	208	60	403	6	250	450	500
	230		365	6	3/0	450	500
	380		221	3	4/0	250	300
	460		183	3	3/0	225	250
	575		147	3	1/0	175	200
170C	208	60	458	6	250	600	600
	230		415	6	250	500	600
	380		251	3	250	300	350
	460		208	3	4/0	250	300
	575		167	3	2/0	200	225
180C	208	60	497	6	250	600	700
	230		450	6	250	600	600
	380		272	3	300	350	400
	460		225	3	4/0	300	300
	575		180	3	3/0	250	250
190C	208	60	502	6	250	600	700
	230		455	6	250	600	600
	380		275	3	300	350	350
	460		228	3	4/0	300	300
	575		183	3	3/0	225	250
200C	208	60	541	6	300	700	700
	230		490	6	250	600	700
	380		296	3	350	350	400
	460		245	3	250	300	350
	575		196	3	3/0	225	250
210C	208	60	572	6	350	700	800
	230		518	6	300	600	700
	380		313	3	400	400	450
	460		259	3	300	300	350
	575		207	3	4/0	250	250

NOTES:

1. Allowable voltage range is within ±10% of nameplate rating.
2. Minimum circuit ampacity is equal to 125% of the RLA of the largest motor plus 100% of the RLA of all other loads in the circuit.
3. Recommended power lead wire sizes based on three conductors per conduit at 100% conductor ampacity using 75°C wire and no more than 3 conductors per conduit.
4. For six conductors per conduit current carrying capacity is reduced by 20%. Consult the National Electical Code for wire sizing. All terminal block connections must be made with copper wire (type THW or THHN).
5. Recommended time delay fuse size or circuit breakers (Canadian units only) is equal to 150% of the largest compressor-motor RLA plus 100% of all other loads on the circuit. Maximum time delay fuse size or circuit breakers (Canadian units only) is equal to 225% of the largest compressor-motor RLA plus 100% of all other loads on the circuit.

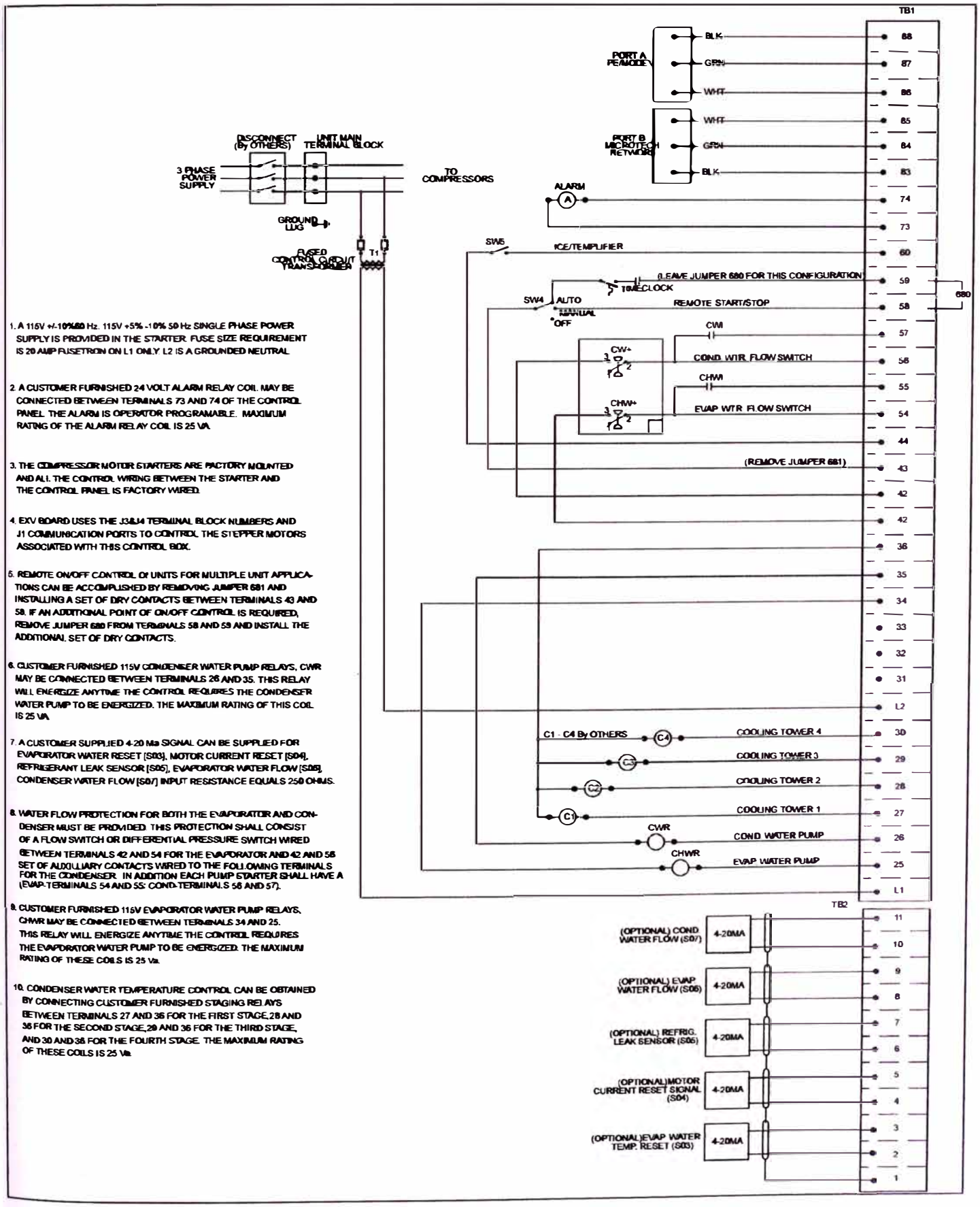
Table 14, Electrical Data

PFS Unit Size	Volts	Hz	Minimum Circuit Ampacity (MCA) Ckt.1 / Ckt.2	Power Supply Field Wire Qty.(3) Ckt.1 / Ckt.2	Power Supply Field Wire Wire Guage Ckt.1 / Ckt.2	Field Fuse Size Recom-mended Ckt.1 / Ckt.2	Field Fuse Size Maximum Ckt.1 / Ckt.2
235C	208	60	358 / 358	6 / 6	3/0 / 3/0	450 / 450	600 / 600
	230		324 / 324	6 / 6	2/0 / 2/0	400 / 400	500 / 500
	380		353	6	3 / 0	400	500
	460		293	3	350	350	400
	575		234	3	250	300	300
255C	208	60	358 / 446	6 / 6	3/0 / 4/0	450 / 600	600 / 800
	230		324 / 404	6 / 6	2/0 / 4/0	400 / 500	500 / 700
	380		401	6	250	450	500
	460		333	3	400	400	450
	575		267	3	300	300	350
270C	208	60	358 / 508	6 / 6	3/0 / 250	450 / 700	600 / 800
	230		324 / 460	6 / 6	2/0 / 4/0	400 / 600	500 / 800
	380		435	6	250	500	500
	460		360	3	500	450	500
	575		288	3	350	350	400
280C	208	60	446 / 446	6 / 6	4/0 / 4/0	600 / 600	800 / 800
	230		404 / 404	6 / 6	4/0 / 4/0	500 / 500	700 / 700
	380		439	6	250	500	600
	460		365	3	500	450	500
	575		293	3	350	350	400
300C	208	60	446 / 508	6 / 6	4/0 / 250	600 / 700	800 / 800
	230		404 / 460	6 / 6	4/0 / 4/0	500 / 600	700 / 800
	380		473	6	250	600	600
	460		392	6	3 / 0	450	500
	575		314	3	400	400	450
315C	208	60	508 / 508	6 / 6	250 / 250	700 / 700	800 / 800
	230		460 / 460	6 / 6	4/0 / 4/0	600 / 600	800 / 800
	380		500	6	250	600	700
	460		414	6	250	500	500
	575		331	3	400	400	450

NOTES:

1. Allowable voltage limit is within ±10 percent of nameplate rating.
2. 235C-315C units for 208V & 230V applications require two electrical circuits and have two power blocks. Optional "main circuit breaker" and "compressor circuit breakers" are not available with these units.
3. Recommended power lead wire sizes based on three conductors per conduit at 100% conductor ampacity using 75°C wire and no more than 3 conductors per conduit.
4. For six conductors per conduit current carrying capacity is reduced by 20%. Consult the National Electical Code for wire sizing. All terminal block connections must be made with copper wire (type THW or THHN).
5. Recommended time delay fuse size or circuit breakers (Canadian units only) is equal to 150% of the largest compressor-motor RLA plus 100% of all other loads on the circuit. Maximum time delay fuse size or circuit breakers (Canadian units only) is equal to 225% of the largest compressor-motor RLA plus 100% of all other loads on the circuit.

Figure 31, Typical Field Wiring



1. A 115V +/-10%60 Hz. 115V +5% -10% 50 Hz SINGLE PHASE POWER SUPPLY IS PROVIDED IN THE STARTER. FUSE SIZE REQUIREMENT IS 20 AMP FUSETRON ON L1 ONLY. L2 IS A GROUNDED NEUTRAL.

2. A CUSTOMER FURNISHED 24 VOLT ALARM RELAY COIL MAY BE CONNECTED BETWEEN TERMINALS 73 AND 74 OF THE CONTROL PANEL. THE ALARM IS OPERATOR PROGRAMABLE. MAXIMUM RATING OF THE ALARM RELAY COIL IS 25 VA.

3. THE COMPRESSOR MOTOR STARTERS ARE FACTORY MOUNTED AND ALL THE CONTROL WIRING BETWEEN THE STARTER AND THE CONTROL PANEL IS FACTORY WIRED.

4. EXV BOARD USES THE J3&J4 TERMINAL BLOCK NUMBERS AND J1 COMMUNICATION PORTS TO CONTROL THE STEPPER MOTORS ASSOCIATED WITH THIS CONTROL BOX.

5. REMOTE ON/OFF CONTROL OF UNITS FOR MULTIPLE UNIT APPLICATIONS CAN BE ACCOMPLISHED BY REMOVING JUMPER 681 AND INSTALLING A SET OF DRY CONTACTS BETWEEN TERMINALS 43 AND 58. IF AN ADDITIONAL POINT OF ON/OFF CONTROL IS REQUIRED, REMOVE JUMPER 680 FROM TERMINALS 58 AND 59 AND INSTALL THE ADDITIONAL SET OF DRY CONTACTS.

6. CUSTOMER FURNISHED 115V CONDENSER WATER PUMP RELAYS, CWR MAY BE CONNECTED BETWEEN TERMINALS 26 AND 35. THIS RELAY WILL ENERGIZE ANYTIME THE CONTROL REQUIRES THE CONDENSER WATER PUMP TO BE ENERGIZED. THE MAXIMUM RATING OF THIS COIL IS 25 VA.

7. A CUSTOMER SUPPLIED 4-20 Ma SIGNAL CAN BE SUPPLIED FOR EVAPORATOR WATER RESET [S03], MOTOR CURRENT RESET [S04], REFRIGERANT LEAK SENSOR [S05], EVAPORATOR WATER FLOW [S06], CONDENSER WATER FLOW [S07] INPUT RESISTANCE EQUALS 250 OHMS.

8. WATER FLOW PROTECTION FOR BOTH THE EVAPORATOR AND CONDENSER MUST BE PROVIDED. THIS PROTECTION SHALL CONSIST OF A FLOW SWITCH OR DIFFERENTIAL PRESSURE SWITCH WIRED BETWEEN TERMINALS 42 AND 54 FOR THE EVAPORATOR AND 42 AND 56 SET OF AUXILLIARY CONTACTS WIRED TO THE FOLLOWING TERMINALS FOR THE CONDENSER. IN ADDITION EACH PUMP STARTER SHALL HAVE A (EVAP-TERMINALS 54 AND 55: COND-TERMINALS 56 AND 57).

9. CUSTOMER FURNISHED 115V EVAPORATOR WATER PUMP RELAYS, CHWR MAY BE CONNECTED BETWEEN TERMINALS 34 AND 25. THIS RELAY WILL ENERGIZE ANYTIME THE CONTROL REQUIRES THE EVAPORATOR WATER PUMP TO BE ENERGIZED. THE MAXIMUM RATING OF THESE COILS IS 25 Va.

10. CONDENSER WATER TEMPERATURE CONTROL CAN BE OBTAINED BY CONNECTING CUSTOMER FURNISHED STAGING RELAYS BETWEEN TERMINALS 27 AND 36 FOR THE FIRST STAGE, 28 AND 36 FOR THE SECOND STAGE, 29 AND 36 FOR THE THIRD STAGE, AND 30 AND 36 FOR THE FOURTH STAGE. THE MAXIMUM RATING OF THESE COILS IS 25 Va.

Pre-Start-up

1. Open all electrical disconnects and check electrical connections are tight.
2. Verify water piping flow directions are correct and properly connected at the evaporator and condenser.
3. Using a phase tester, verify electrical phasing is A-B-C clockwise (A=L1, B=L2,C=L3).
4. Verify unit power supply is within 10% of nameplate rating.
5. Verify power supply wiring is the correct size and has a minimum temperature insulation rating of 75°C.
6. Verify all mechanical and electrical inspections have been completed according to local code.
7. Make certain all auxilliary control equipment is operative and an adequate cooling load is available.
8. Check all compressor valve connections for tightness.
9. Open compressor suction valve until backseated. (This is an optional valve)
10. Open discharge shutoff valve until backseated
11. Vent air from the evaporator and condenser water system piping.
12. Open all water flow valves and start chilled water pump.
13. Check all piping for leaks.
14. Flush the evaporator and condenser system piping.

Sequence of Operation

The following sequence of operation is typical for McQuay models PFS155C through PFS315C screw water chillers. The sequence may vary depending on the software revision or various options that maybe installed on the chiller.

Initial Conditions

Before energizing the control box, do the following:

1. Verify the two control circuits are powered through the primary fuses FU1, FU2 and the secondary fuse FU3.
2. Verify power is developed through the transformer CPT in the starter and is 120 VAC on the secondary.
3. Make certain the S1 switch is in the off position.

When applying power to the control for the first time do the following:

1. Open left door and the top door to each control box.
2. Apply power and observe the following:
   - Display lights up
   - Unit Status screen appears
   - EXV board lights rapidly sequence closed.
3. Listen for stepper motors closing with a racheting sound.
4. Verify Unit Status Screen on the display indicates **Off: Front Panel Sw.**

Off Conditions

With the power on the controller there several off states:

Off: Manual: when the setpoint in menu "11 Control Mode" is set to the *Mode= Manual Off*. To change, simply set the *Mode= Auto: Network* (or any other running mode).

Off: Front Panel Sw: when the panel switch is in the "Stop" position. To change move the switch to "Auto" position.

Off Alarm remove the alarm state then clear the alarm to remove this off state.

Off Compressor 1 or **Off Compressor 2** is the on / off switch inside the top right control box door. Turn to 'on' to clear.

Alarm

The alarm light on the front panel illuminates when the particular control receives an active alarm state. The unit or a particular compressor will be locked out. The other compressor will start if only one is locked out by a compressor fault.

Initial Start-up

CAUTION

Initial Start-up must be performed by McQuayService personnel.

1. Set up control as described in Initial Conditions.
2. Turn front panel switch to Auto position. (chilled water flow pump relay will energize.)
3. If the field installed flow indicator does not indicated chilled water flow after 30 seconds, then the alarm output will be energized.

Note: The unit starts the compressor with the least starts and run hours while in auto lead lag setting

4. When the Active Setpoint is 3 °F lower than the actual leaving water temperature, the chiller starts.
5. When the chiller starts the following occurs:
   - Crank case heaters de-energize
   - Compressor starts
   - Liquid injection solenoid is energized
   - Motor cooling solenoid is energized
   - Suction injection solenoids are energized
6. Suction injection will turn off when the following conditions have been met:
   - Discharge superheat drops below 3 °F
   - Liquid Presence sensor shows liquid
   - Absolute Pressure ratio is greater than 1.2 (Abs. Condenser Psia / Abs. Evaporator Psia)

7. The unit status changes:

FROM	TO
EvapOn-Recirc **Sec	All Systems Off
All Systems Off	MCR Started
MCR Started	Pre-purge
Pre-purge	Open Solenoid
Open Solenoid	Running Min Amp Lim
Running Min Amp Lim	Running: % Cap 50

8. The following occurs if additional cooling capacity is required:
   - Controllers add capacity by changing the capacity control solenoids outputs 6, 7, and 8.
   - As capacity increases the second compressor is started
   - After both compressor are running the unit continues to load by changing the capacity control solenoids outputs 12, 13, and 14.

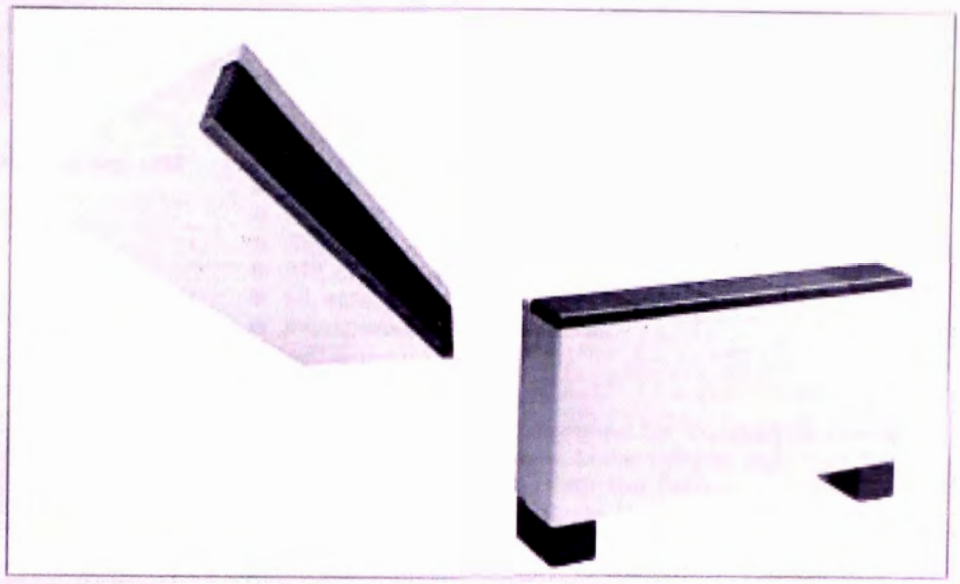
Load Recycle

As chilled water requirements lessen, the controls unload the compressors until the chilled water drops below the lag cutoff point for the delay time required. The control will shut off the lag compressor and reduced load will cause the leaving water temperature to drop 3 ° F below the active setpoint. The compressor de-energizes on Load Recycle and the display will show Waiting For Load. The chilled water pump will remain on.

McQuay International

13600 Industrial Park Boulevard, P.O. Box 1551, Minneapolis, MN 55440 USA (612) 553-5330

Catalog 720-8



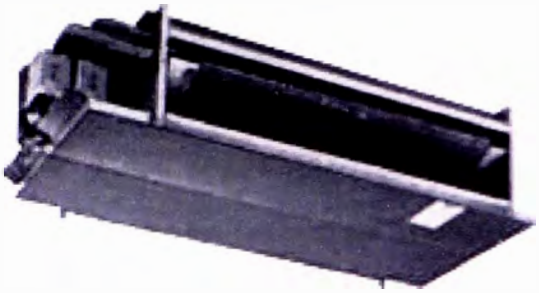
SeasonMaker ThinLine Fan-coil Units G Vintage

Models TSH & TSC TSF & TSB

Ratings Certified by the Air Conditioning & Refrigeration Institute

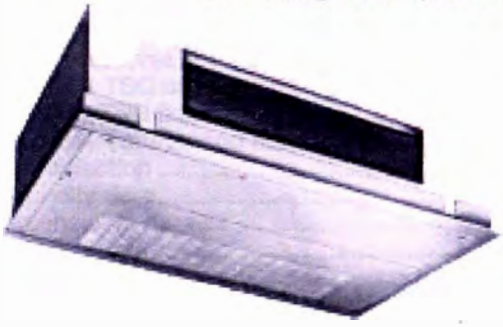
McQuay Air Conditioning

Total fan-coil flexibility

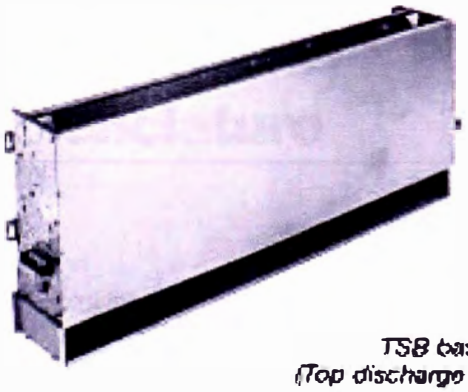


TSH hideaway unit

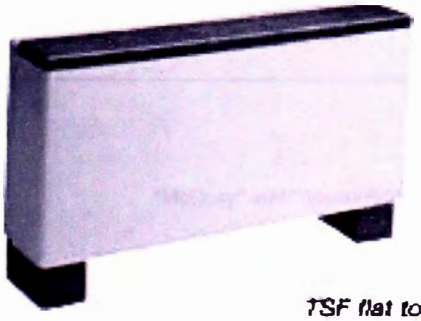
TSC ceiling unit; exposed cabinet



TSC ceiling unit; recessed cabinet



TSB basic unit;
(Top discharge shown)



TSF flat top floor unit

TSH hideaway unit

The TSH hideaway unit is designed for fully concealed installation in areas where a ceiling enclosure is furnished by others. Unit features include:

- 7 unit sizes from 200 to 1200 cfm (340 to 2040 m³/h).
- Heavy-gauge galvanized steel base casing.
- Standard or high capacity cooling coil.
- Quiet, 3-speed permanent split capacitor motor(s).
- High performance forward curved centrifugal fan wheels.
- Single power location for field wiring connections.
- ARI certified performance.
- UL safety agency approval listing.
- Incorporates IAQ standards.

TSC ceiling unit

The TSC ceiling unit is designed for exposed or recessed ceiling applications. An optional cabinet with trim flange frame allows installation with the cabinet hinged bottom panel flush with the ceiling for recessed applications. The unit includes all of the features listed above for the TSH unit plus the following:

- 7 unit sizes from 200 to 1200 cfm (340 to 2040 m³/h).
- Heavy-gauge steel decorative cabinet with polymer or stamped discharge grille or duct opening.
- Attractive Antique Ivory electrostatically applied, baked-on finish.
- Hinged bottom panel for total accessibility to the unit, controls and filter.
- Stamped return air grille or back return duct opening.
- Optional cabinet with telescoping trim flange frame to accommodate any ceiling type for recessed applications.
- Incorporates IAQ standards.

TSB basic unit

The TSB basic unit is designed for fully concealed floor or wall mounted applications. The unit can be installed in a custom enclosure or behind a McQuay wall plate. Decorative wall plates include stamped return air grilles and access door. They are available with or without stamped discharge grille. Wall plates are finished with an attractive Antique Ivory electrostatically applied, baked-on finish. TSB basic unit features include:

- 7 unit sizes form 200 to 1200 cfm (340 to 2040 m³/h).
- Heavy-gauge galvanized steel basic cabinet.
- Standard or high capacity cooling coil.
- Quiet, 3-speed permanent split capacitor motor.
- High performance forward curved centrifugal fan wheels.
- Single power location for field wiring connections.
- ARI certified performance.
- UL safety agency approval.
- Incorporates IAQ standards.

TSF floor unit

The TSF floor unit is designed for use in different installations as a floor console most frequently installed below a window for draft free performance or as a wall hung console. The TSF unit can be provided with either a flat top or a slope top discharge. The standard discharge grille is made of a high impact polymer. Units can also be provided with an optional steel discharge grille. The unit includes all of the features listed above for the TSB unit incorporated in an attractive cabinet painted with electrostatically applied, baked-on, Antique Ivory finish.

McQuay SeasonMaker® ThinLine fan-coil units

ARI certification, UL listing

McQuay ThinLine fan-coil units are tested and rated in accordance with Air Conditioning and Refrigeration Institute (ARI) Standard 440 and certified in accordance with the ARI certification program. ARI certification assures you full rated performance and offers confidence in unit selection.

ThinLine fan-coil units are listed by UL as complying with nationally recognized safety standards for fan-coil air conditioning units.

Ratings Certified by the Air Conditioning & Refrigeration Institute

Indoor air quality

Indoor air quality is an increasingly important issue in the effort to maintain a clean, healthy environment in offices, hotels and schools. ThinLine fan-coils are at the forefront of this effort. All ThinLine models are completely free of fiberglass, which could be entrained in the airstream and enter the conditioned space. ThinLine units utilize sloped drain pans which provide for positive condensate drainage inhibiting the formation of mold or mildew. Floor models also include an option to introduce fresh air into the space.

Contents

Nomenclature

T SF - 02 1 G

- **T** — ThinLine
- **SF** — Type of Unit
  - SF = Floor Cabinet Unit
  - SB = Floor Basic Unit
  - SH = Ceiling Hideaway Unit
  - SC = Ceiling Cabinet Unit
- **02** — Unit Size, Nominal cfm in 100's (02 = 200, etc.)
- **1** — Application Series
- **G** — Design Vintage

(1/96)

Design features — TSH & TSC ceiling units

Quality, efficiency & reliability built into every unit

Coils

Standard and optional high capacity cooling coils include manual air vents for all unit sizes as standard. Optional water heating coils are available for 4-pipe systems.

Coils are constructed of seamless copper tubes with headers and aluminum fins. Full depth collars, drawn in the fin stock, provide accurate control of fin spacing and completely cover the copper tubes to lengthen coil life. Tubes are mechanically expanded into the fins for a permanent primary to secondary surface bond, assuring maximum heat transfer efficiency.

The sloped position of the coil assures rapid condensate drainage to provide even airflow and full rated capacity at all conditions.

Motors

Tap wound, three-speed, permanent split capacitor motors are standard for TSH and TSC units. Motors have sleeve or ball bearings, inherent thermal overload protection an automatic reset. Motors are resiliently mounted to assure quiet, vibration-free operation and are easily removed.

Fan wheels

All fan wheels are forwardly curved, double width, double inlet, centrifugal type and are statically and dynamically balanced for smooth, quiet operation.

Return air duct collar

A standard galvanized steel return air duct collar facilitates connection of TSH units to ductwork. The collar facilitates making the return air connection without interfering with the piping for the unit supply, return or drain connections. It incorporates a filter frame to hold a cleanable filter (filter included) and accommodates easy side or bottom filter access.

Casing and cabinet

All units constructed of heavy-gauge steel for long life and durability. The TSC exposed cabinet is designed to be aesthetic pleasing and still allow easy serviceability. The exposed cabinet is available in a flat front or slope front grille configuration with high impact polymer or metal grilles. Extended length exposed cabinets are available to accomodate valve packages or piping accessories which require additional end pocket space. The TSC recessed cabinet includes a trim flange for adjustment of the bottom panel to match the height of a hanging ceiling. TSC unit cabinet configurations are finished with electrostatically applied, baked-on Antique Ivory paint.

Single power location

All electrical components of the TSH and TSC fan-coils are factory wired to a single location for quick connection to electrical service. Connections for electric heaters, which require a separate circuit, are located in the single power location.

Speed controller

A three-speed switch with off position is available for all sizes. The speed switch must be field mounted in a 2 x 4 x 2½" deep (51 x 102 x 64 mm) electrical box by others.

Drain pans

The galvanized steel primary drain with copper connection is insulated on the external surface with fire rated closed cell foam. The sloped primary drain pan extends under the coil, coil connections and valve area providing complete condensate drainage protection for the entire unit according to IAQ standards.

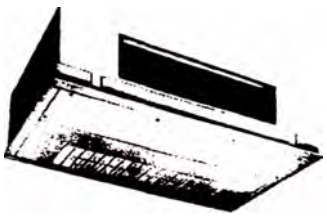
Filter

TSC units have a cleanable filter as standard. The filter is easily removable through the bottom access panel. TSH units include a standard return air duct collar with filter.

Exposed TSC unit with flat front grille

Exposed TSC unit with slope front grille

Recessed TSC ceiling unit



TSH hideaway unit

Design features — TSF & TSB floor units

Quiet, dependable, trouble-free performance

Coils

Standard and optional high capacity cooling coils include manual air vents for all unit sizes as standard. Optional water heating coils are available for 4-pipe systems.

Coils are constructed of seamless copper tubes with headers and aluminum fins. Full depth collars, drawn in the fin stock, provide accurate control of fin spacing and completely cover the copper tubes to lengthen coil life. Tubes are mechanically expanded into the fins for a permanent primary to secondary surface bond, assuring maximum heat transfer efficiency.

The position of the coil assures rapid condensate drainage to provide even airflow and full rated capacity at all conditions.

Motors

Tap wound, three-speed, permanent split capacitor motors are standard for TSF and TSB units. Motors have sleeve or ball bearings, inherent thermal overload protection an automatic reset. Motors are resiliently mounted to assure quiet, vibration-free operation and are easily removed.

Fan wheels

All fan wheels are forwardly curved, double width, double inlet, centrifugal type and are statically and dynamically balanced for smooth, quiet operation.

Fan deck

Heavy-gauge continuous galvanized steel rigidly supports motors, fan assembly and fan housings as a single unit.

Filter

TSF and TSB units have a cleanable filter as standard. The filter is easily removable through the return air toe space of TSF units and wall plate return air grille for TSB units.

Discharge grille

TSF units are furnished with a standard high impact polymer grille in either a flat top or slope configuration. An optional metal grille is available for either configuration. Both grilles have been designed for exceptional airflow while providing a smooth, aesthetically pleasing appearance. Grilles are finished in an Oxford Brown color to complement the Antique Ivory cabinet.

Casing and cabinet

All units constructed of heavy-gauge steel for long life and durability. The TSF cabinet is designed to be aesthetic pleasing and still allow easy serviceability. The cabinet is available in a flat top or slope top grille configuration with high impact polymer or metal grilles. Extended length cabinets are available to accommodate valve packages or piping accessories which require additional end pocket space. The TSF cabinets and TSB wall plates are finished with an electrostatically applied, baked-on Antique Ivory paint.

Single power location

All electrical components of the TSF and TSB fan-coils are factory wired to a single location for quick connection to electrical service. Connections for electric heaters, which require a separate circuit, are located in the single power location.

Speed controller

A three-speed switch with off position is available for all unit sizes. The speed switch is available unit mounted or for field installation in a wall mounted 2 x 4 x 2½" deep (51 x 102 x 64 mm) electrical box by others.

Controls systems

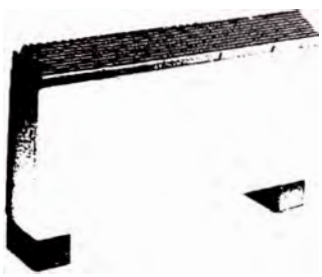
A variety of two- and four-pipe control systems are available with unit mounted or remote thermostats. Standard options include fan or valve cycle control systems. Unit mounted controls are provided with an access door, 3-speed fan switch, off switch, and temperature control knob.

Drain pans

The galvanized steel primary drain is provided with plastic connections, and is insulated on the external surface with fire-rated closed cell foam. The sloped primary drain pan extends under the coil and coil connections. An injection molded secondary drain pan provides complete condensate drainage from valve package components. Together the drain pans provide positive condensate drainage according to IAQ standards.

TSF flat top unit

TSF slope top unit



TSB basic unit

Optional features and accessories

Optional coils

In addition to the standard cooling coil, an optional high capacity water coil is available for all floor and ceiling units for use in two-pipe systems. A separate one-row heating coil can be factory installed with any of the above coils for four-pipe systems.

Motors

Tap wound, three-speed 115/60/1, 230/60/1, 220/50/1, or 277/60/1 permanent split capacitor motors are available on all unit types and sizes. High static motors are also available. Motors have sleeve or ball bearings and inherent thermal overload protection with automatic reset. Motors are resiliently mounted to assure quiet, vibration-free operation and are easily removed for service.

Electric heat

Electric heat is offered in a wide variety of sizes and voltages. Each is equipped with an high limit cutout switch, interlocked with the fan switch to prevent operation during periods when the fan is off. Electric heaters can be used for supplementary between-season heating when chilled water is being supplied to the system, or for year-round electric heat.

Valve packages

Two-way and three-way electric valves are available with hand valves for factory mounting on all units. All valve packages have a union connections between the valve and coil allowing quick valve removal. TSF and TSB units include a secondary drain pan to assure positive drainage of condensate from valves and piping manifolds. TSH and TSC units have a secondary drain pan as part of the unit drain pan.

Wall plates (TSB units only)

Decorative wall plates include stamped return air grilles and an access door. They are available with or without stamped discharge grille. Wall plates are finished with an attractive Antique Ivory electrostatically applied, baked-on finish.

Fresh air damper

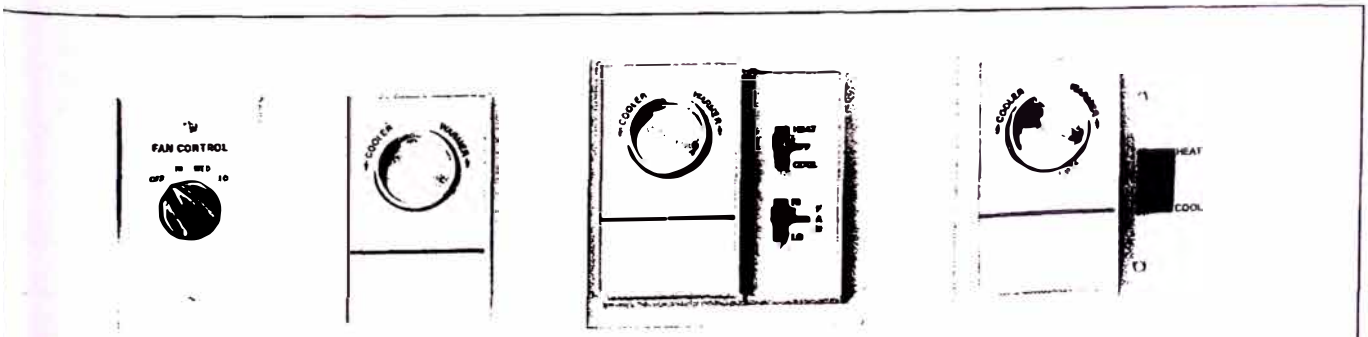
An automatic or manual fresh air damper, with user adjustable settings for fresh air intake, is available factory installed or as a field installed kit. The damper can quickly and easily be adjusted to allow 100, 50, 25 or 0 percent fresh air intake. If freezing air temperatures are expected the damper must be closed or the outside air tempered before entering the unit.

Fresh air wall intake box

Fabricated of aluminum with weep holes and a double set of louvers in series to prevent moisture draw-through.

Thermostats

Wall-mounted thermostats for all application requirements are available as either thermostats only or combination thermostat and three-speed switch. Unit mounted thermostats are available for TSF and TSB units.



Wall mounted three-speed fan switch and thermostats

Unit selection

Selection of unit type

General

The achievement of an efficient fan-coil system is dependent upon accurate system design and proper equipment selection. Variations, limltations and control of fan-coil systems, design conditions and design load calculations are not described in detail in the is catalog. More detailed information may be found in the ASHRAE Guide. This catalog contains ARI certified ratings and application ratings for ThinLine SeasonMaker fan-coil units from which the design engineer can make initial unit selections to meet the requirements of the system.

The mechanical system designer must select the unit types best suited to the overall system before the actual unit sizes can be determined. The factors that generally influence this decision are intended building usage, building layout, architectural and aesthetic values, economics, geographical location, and type of maintenance service available. The general results may be a mixture of various unit types within a glven system. McQuay International manufactures a fan-coil unit to meet your every need Including ThinLine, HiLIne and Large Capacity models.

Basic design data

Prior to selecting the individual unit sizes, the design engineer must fix or determine the following factors:

1. Inside and outside wet and dry bulb deslgn temperatures.
2. Method of introducing the ventilation alr.
3. Wet and dry bulb temperatures of the alr mixture entering the unit coil.
4. Total and sensible heat gains and losses of the area to be served.
5. Properties of the heating and cooling medium.
6. Available electric power service.
7. Any special design requirements of the building or system.

Selection of unit size

The capacity rating presented in this catalog are provided for initial unit selection only. Unit size selection should be determined by using the SelectTools™ Fan-coil Computer Selection Program. Water cooling and heating capacities, unit air flow, static pressure, electric heat and glycol solutions are all incorporated into the program to provide the best possible selection. Consult you McQuay representative for a selection tailored to your application.

Unit sizes for the ideal system should be selected by calculating the peak load requirements due to unusually high occupancy or severe climatic conditions and with fan operating at high speed. Ordinary day to day cooling and heating requirements are then achieved at low and medium speeds.

Ventilation requirements should be considered along with heating and cooling capacity to determine the proper unit size. Outside fresh air must be tempered before entering the unit if freezing conditions are expected. For applications involving ceiling units with extensive ductwork, a high static fan motor is available.

Cooling coil requirements

Having checked the minimum unit size to meet the ventilation requirement, the unit size is generally selected on the basis of matching the sensible cooling capacity of the unit with the calculated requirements when operating at high speed.

Coils

Standard and high capacity coils are available for all ThinLine floor and ceiling models and sizes to permit unit selections for optimum performance.

- Standard coils are designed to meet both the cooling and heating requirements in a typical system.
- High capacity coils are designed to meet cooling and heating loads that exceed typical system requirements for ceiling units.

Heating requirements

Heating requirements for two-pipe systems are generally met by employing the same water flow rate as cooling and adjusting the entering hot water temperature to obtain a matching unit heat output at low fan speed. Four-pipe systems are generally designed by specifying the flow rate through the separate heating coil to meet the required heat load with the fan operating at low speed.

Electric heaters are available for primary year-round heating or intermediate between-seasons heat loads for two-pipe systems when chilled water is in the system.

ARI approved standard ratings

All ThinLine models TSF/TSB/TSC/TSH

Table 2. Standard water coil cooling capacity ratings ①

UNIT SIZE	COOLING CAPACITY ②				WATER FLOW		WATER P.D.	
	TOTAL		SENSIBLE					
	BTUH	WATTS	BTUH	WATTS	GPM	L/h	FT. W.C.	kPa
021G	7680	2250	5260	1541	1.6	364	1.8	5.4
031G	8440	2473	6120	1793	2.0	455	3.5	10.5
041G	13100	3838	9090	2663	2.8	637	7.4	22.1
061G	17000	4981	11920	3493	3.6	819	15.2	45.5
081G	24830	7275	17660	5174	4.6	1047	6.6	19.7
101G	30070	8811	23900	7003	6.3	1433	14.7	44.0
121G	33200	9728	24620	7214	6.9	1570	16.4	49.0

Table 3. High capacity water coil cooling capacity ratings ①

UNIT SIZE	COOLING CAPACITY ②				WATER FLOW		WATER P.D.	
	TOTAL		SENSIBLE					
	BTUH	WATTS	BTUH	WATTS	GPM	L/h	FT. W.C.	kPa
021G	8170	2394	5350	1568	1.7	387	1.0	3.0
031G	10390	3044	6720	1969	2.2	501	3.8	11.4
041G	13920	4079	9610	2816	3.0	683	3.8	11.4
061G	18530	5429	12650	3706	3.9	887	6.4	19.1
081G	29060	8515	24060	7050	6.1	1388	3.9	11.7
101G	35970	10539	24770	7258	7.3	1661	7.8	23.3
121G	46060	13496	29100	8526	9.9	2252	16.1	48.1

Notes:

① Rated in accordance with ARI 440. Cooling capacities based on 80°F DB/67°F WB (27/19°C) entering air, 45°F entering water, 10°F (5.5°C) water temperature rise and high fan speed with standard 115/60/1 motor. See Tables 8 and 9 for air volume capacities.

② For coil capacity ratings at conditions other than that listed, including other voltage motors, refer to the SelectTools™ Fan-coil Computer Selection Program or consult your McQuay representative.

Water heating coil rating

All ThinLine models TSF/TSB/TSC/TSH

Table 4. Standard coil water heating capacity ratings ①

UNIT SIZE	HEATING CAPACITY ②		WATER FLOW		WATER P.D.	
	BTUH	WATTS	GPM	L/h	FT. W.C.	kPa
021G	18396	5390	1.2	280	1.4	4.3
031G	24812	7270	1.6	375	2.8	8.4
041G	34471	10100	2.3	520	5.8	17.2
061G	41536	12170	2.8	630	1.4	4.3
081G	63413	18580	4.2	960	4.3	12.8
101G	79829	23390	5.3	1210	7.1	21.3
121G	96430	28250	6.5	1480	11.2	33.5

Table 5. High capacity water coil heating capacity ratings ①

UNIT SIZE	HEATING CAPACITY ②		WATER FLOW		WATER P.D.	
	BTUH	WATTS	GPM	L/h	FT. W.C.	kPa
021G	22048	6460	1.5	335	2.8	8.5
031G	28840	8450	1.9	440	1.8	5.3
041G	40512	11870	2.7	615	3.7	11.1
061G	50683	14850	3.4	770	6.2	18.5
081G	70956	20790	4.7	1075	2.5	7.6
101G	92457	27090	6.2	1400	4.5	13.4
121G	103859	30430	7.0	1590	6.1	18.2

Table 6. Separate one row water coil heating capacity ratings ①

UNIT SIZE	HEATING CAPACITY ② ③		WATER FLOW		WATER P.D.	
	BTUH	WATTS	GPM	L/h	FT. W.C.	kPa
021G	14437	4230	1.0	220	2.6	7.7
031G	19249	5640	1.3	290	5.2	15.4
041G	25597	7500	1.7	390	1.9	5.6
061G	31980	9370	2.1	485	3.1	9.2
081G	44573	13060	3.0	675	3.1	9.2
101G	56758	16630	3.8	860	13.4	40.1
121G	70773	20740	4.6	1045	20.5	61.3

Notes:

① Water heating coils rated at 70°F DB (21°C) entering air, 180°F (82°C) entering water, 30°F (17°C) water temperature drop and high fan speed with standard 115/60/1 motor. See Tables 8 and 9 for air volume capacities.

② For heating coil capacity ratings at conditions other than that listed, including other voltage motors, refer to the SelectTools™ Fan-coil Computer Selection Program or consult your McQuay representative.

③ When 1-row heating coils are used in conjunction with high capacity cooling coils, a de-rate factor of 0.92 must be applied to the heating capacity.

Electric heat capacity ratings

All ThinLine models TSF/TSB/TSC/TSH

Table 7. Electric resistance heater capacities

UNIT SIZE	115/60/1			230/60/1			220/50/1			277/60/1		
	WATTS	BTUH	AMPS	WATTS	BTUH	AMPS	WATTS	BTUH	AMPS	WATTS	BTUH	AMPS
021G	500	1706	4.2	500	1706	2.2	500	1706	2.3	500	1706	1.8
	1000	3413	8.3	1000	3413	4.4	1000	3413	4.6	1000	3413	3.6
	1500	5119	12.5	1500	5119	6.5	1500	5119	6.8	1500	5119	5.4
031G	1000	3413	8.3	1000	3413	4.4	1000	3413	4.6	1000	3413	3.6
	1500	5119	12.5	1500	5119	6.5	1500	5119	6.8	1500	5119	5.4
	—	—	—	2000	6826	8.8	2000	6826	9.2	2000	6826	7.2
041G	1000	3413	8.3	1000	3413	4.4	1000	3413	4.6	1000	3413	3.6
	1500	5119	12.5	1500	5119	6.5	1500	5119	6.8	1500	5119	5.4
	—	—	—	2000	6826	8.8	2000	6826	9.2	2000	6826	7.2
061G	1000	3413	8.3	1000	3413	4.4	1000	3413	4.6	1000	3413	3.6
	—	—	—	2000	6826	8.8	2000	6826	9.2	2000	6826	7.2
	—	—	—	4000	13652	17.4	4000	13652	18.2	4000	13652	14.4
081G	—	—	—	2000	6626	8.8	2000	6826	9.2	2000	6826	7.2
	—	—	—	4000	13652	17.4	4000	13652	18.2	4000	13652	14.4
	—	—	—	6000	20478	26.1	6000	20478	27.3	6000	20478	21.7
101G	—	—	—	4000	13652	17.4	4000	13652	18.2	4000	13652	14.4
	—	—	—	6000	20478	26.1	6000	20478	27.3	6000	20478	21.7
	—	—	—	—	—	—	—	—	—	8000	27304	28.9
121G	—	—	—	4000	13652	17.4	4000	13652	18.2	4000	13652	14.4
	—	—	—	6000	20478	26.1	6000	20478	27.3	6000	20478	21.7
	—	—	—	—	—	—	—	—	—	8000	27304	28.9

Motor data

All ThinLine models TSF/TSB/TSC/TSH

Table 8a. Standard motors, 2-row coil

UNIT SIZE	MTR SPEED	115/60/1		
		AMPS	WATTS	RPM
021G	HIGH	0.50	60.0	1005
	MED.	0.43	53.0	840
	LOW	0.39	49.0	765
031G	HIGH	0.64	76.8	1245
	MED.	0.54	65.2	1028
	LOW	0.47	55.8	846
041G	HIGH	0.55	65.0	940
	MED.	0.42	49.0	800
	LOW	0.33	38.0	690
061G	HIGH	0.82	94.0	1055
	MED.	0.58	67.0	910
	LOW	0.43	50.0	765
081G	HIGH	1.63	197	1210
	MED.	1.38	167	1040
	LOW	1.26	151	930
101G	HIGH	2.24	260	1375
	MED.	2.04	245	1200
	LOW	1.84	223	1010
121G	HIGH	4.61	434	1515
		3.82	419	1425
		3.38	390	1295

*Motor data based on 0.05 esp.

Table 8b. Standard motors, 3-row coil

UNIT SIZE	MTR SPEED	115/60/1		
		AMPS	WATTS	RPM
021G	HIGH	0.50	60.0	1030
	MED.	0.43	54.0	865
	LOW	0.39	49.0	775
031G	HIGH	0.67	82.0	1250
	MED.	0.57	70.0	1040
	LOW	0.50	61.0	870
041G	HIGH	0.54	61.0	950
	MED.	0.42	45.8	810
	LOW	0.32	33.6	695
061G	HIGH	0.82	93.0	1055
	MED.	0.57	67.0	920
	LOW	0.42	49.0	785
081G	HIGH	1.60	195	1235
	MED.	1.37	164	1050
	LOW	1.25	148	950
101G	HIGH	2.26	264	1360
		2.05	247	1200
	LOW	1.84	224	1020
121G	HIGH	4.63	434	1505
		3.80	415	1415
	LOW	3.37	387	1290

*Motor data based on 0.05 esp.

**Contact Minneapolis for high static motor data.

Air volume capacity data

All ThinLine models TSF/TSB/TSC/TSH

Table 9a. High efficiency motor, cfm

UNIT SIZE	EXTERNAL STATIC PRESSURE, IN. W.C.													
	0.0		0.05		0.10		0.15		0.20		0.25		0.30	
	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW
021G	255	173	219	135	194	—	167	—	141	—	117	—	—	—
031G	308	204	263	149	234	112	207	—	179	—	152	—	118	—
041G	463	292	363	195	297	115	213	—	114	—	—	—	—	—
061G	612	427	506	312	427	241	353	167	264	—	141	—	—	—
081G	789	573	727	484	655	416	584	323	503	242	403	170	314	—
101G	926	666	787	528	704	441	573	367	395	279	224	193	—	—
121G	1086	894	988	814	904	724	821	650	735	572	651	485	550	390

Table 9b. High efficiency motor, m³/h

UNIT SIZE	EXTERNAL STATIC PRESSURE, Pa													
	0.0		12.5		24.9		37.4		49.8		62.3		74.7	
	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW
021G	433	294	372	229	330	—	284	—	240	—	199	—	—	—
031G	523	347	447	253	398	190	352	—	304	—	258	—	201	—
041G	787	496	617	331	505	195	362	—	194	—	—	—	—	—
061G	1040	726	860	530	726	410	600	284	449	—	240	—	—	—
081G	1341	974	1235	822	1113	707	992	549	855	411	685	289	534	—
101G	1573	1132	1337	897	1196	749	974	624	671	474	381	328	—	—
121G	1845	1519	1679	1383	1536	1230	1395	1104	1249	972	1106	824	935	663

Table 10a. High static motor, cfm

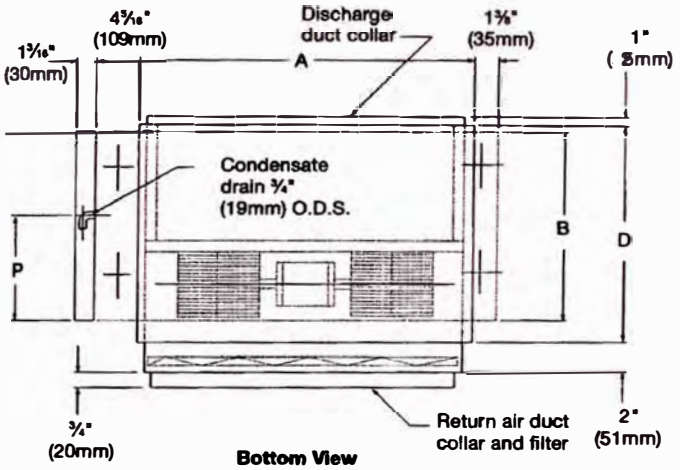
UNIT SIZE	EXTERNAL STATIC PRESSURE, IN. W.C.															
	0.0		0.05		0.10		0.15		0.20		0.25		0.30		0.35	
	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW
021G	330	218	282	159	251	120	222	81	192	—	163	—	126	—	89	—
031G	374	247	319	181	284	136	251	111	217	97	184	—	143	—	101	—
041G	518	295	360	150	230	107	202	96	114	—	95	—	—	—	—	—
061G	614	345	432	160	196	106	120	88	103	—	94	—	—	—	—	—
081G	848	449	764	256	661	127	557	95	428	—	322	—	217	—	102	—
101G	1112	800	945	634	846	530	688	441	474	335	269	232	169	108	111	—
121G	1149	819	966	664	800	570	636	489	428	391	240	197	105	—	—	—

Table 10b. High static motor, m³/h

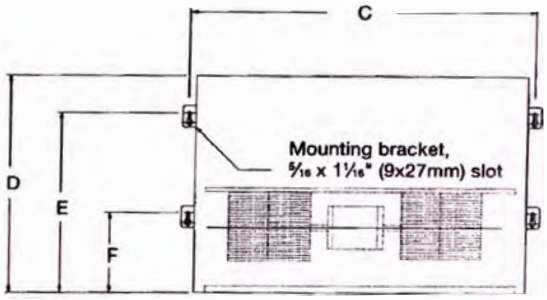
UNIT SIZE	EXTERNAL STATIC PRESSURE, Pa															
	0.0		12.5		24.9		37.4		49.8		62.3		74.7		87.2	
	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW
021G	561	370	479	270	426	204	377	138	326	—	277	—	214	—	151	—
031G	636	420	542	308	483	231	426	189	369	165	313	—	243	—	172	—
041G	880	501	612	255	391	182	343	163	194	—	161	—	—	—	—	—
061G	1043	586	734	272	333	180	204	150	175	—	160	—	—	—	—	—
081G	1441	763	1298	435	1123	216	946	161	727	—	547	—	369	—	173	—
101G	1890	1359	1606	1077	1438	901	1169	749	805	569	457	394	287	184	189	—
121G	1952	1392	1641	1128	1359	969	1081	831	727	664	408	335	178	—	—	—

Note:
Air volume based on 115/60/1 electrical service, standard unit options and dry coils. For applications with other voltages, refer to the SelectTools™ Fan-coil Computer Selection Program or consult your McQuay representative.

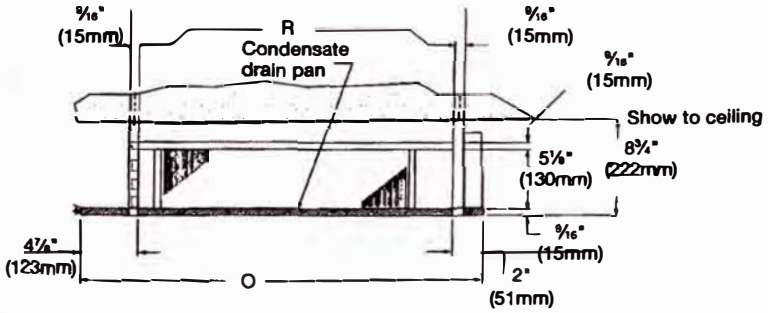
Dimensional data — TSH hideaway ceiling unit



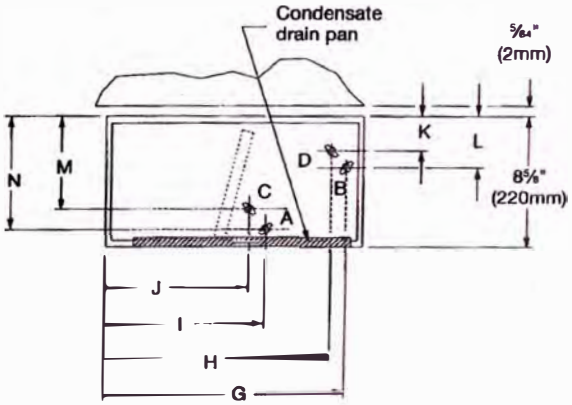
Bottom View
Left-hand Coil Connections Shown



Ceiling Mounting

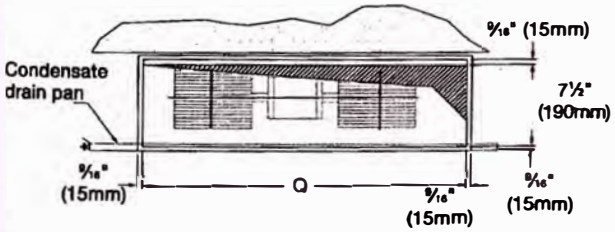


Discharge Duct Connections



Coil Connections
Left-hand Shown

A: Auxiliary coil inlet
B: Auxiliary coil outlet
C: Main coil inlet
D: Main coil outlet



Return Air Duct Connections

Caution:
Do not fasten ductwork to edge of drain pan. (Prevents pan removal)

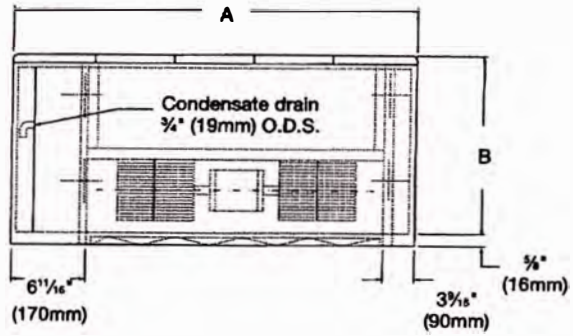
TSH UNIT SIZE	COIL CONNECTION SIZE	
	COOLING	HEATING
021G THRU 121G	⅝" (16 mm) I.D.S.	⅝" (16 mm) I.D.S.

TSH SIZE	DIMENSIONS, INCHES																	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
021G	27⅜	14³⁄₁₆	26⅞	16¹⁵⁄₁₆	14³⁄₁₆	5⅞	16¹⁄₁₆	15⅜	10	9⁵⁄₁₆	2⁵⁄₁₆	3⅞	5¹³⁄₁₆	7⅛	33⅛	7¹¹⁄₁₆	24⅞	26¼
031G	27⅜	14³⁄₁₆	26⅞	16¹⁵⁄₁₆	14³⁄₁₆	5⅞	16¹⁄₁₆	15⅜	10	9⁵⁄₁₆	2⁵⁄₁₆	3⅞	5¹³⁄₁₆	7⅛	33⅛	7¹¹⁄₁₆	24⅞	26¼
041G	41¹³⁄₁₆	14³⁄₁₆	41⅞	16¹⁵⁄₁₆	14³⁄₁₆	5⅞	16¹⁄₁₆	15⅜	10	9⁵⁄₁₆	2⁵⁄₁₆	3⅞	5¹³⁄₁₆	7⅛	47⅞	7¹¹⁄₁₆	39⁷⁄₁₆	40¹³⁄₁₆
061G	49¹³⁄₁₆	14³⁄₁₆	48¾	16¹⁵⁄₁₆	14³⁄₁₆	5⅞	16¹⁄₁₆	15⅜	10	9⁵⁄₁₆	2⁵⁄₁₆	3⅞	5¹³⁄₁₆	7⅛	54¹³⁄₁₆	7¹¹⁄₁₆	46¹¹⁄₁₆	48⅛
081G	49¾₁₆	18⅛	48¾	20⅞	14⅜	6³⁄₁₆	19¹³⁄₁₆	19½	9¹¹⁄₁₆	9¼	1⅝	3¼	5¹¹⁄₁₆	7⅜	54¹³⁄₁₆	7⅞	46¹¹⁄₁₆	48⅛
101G	56½	18⅛	56	20⅞	14⅜	6³⁄₁₆	19¹³⁄₁₆	19½	9¹¹⁄₁₆	9¼	1⅝	3¼	5¹¹⁄₁₆	7⅜	62¼	7⅞	54	55⅞
121G	56½	18⅛	56	20⅞	14⅜	6³⁄₁₆	19¹³⁄₁₆	19½	9¹¹⁄₁₆	9¼	1⅝	3¼	5¹¹⁄₁₆	7⅜	62¼	7⅞	54	55⅞

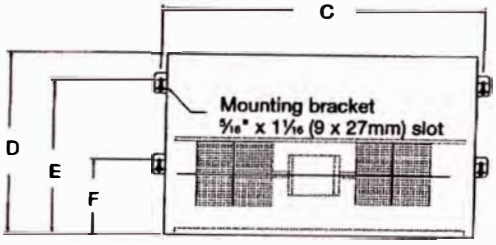
TSH SIZE	DIMENSIONS, MM																	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
021G	695	360	683	430	360	150	406	390	254	237	56	98	147	189	840	196	631	667
031G	695	360	683	430	360	150	408	390	254	237	56	98	147	189	840	196	631	667
041G	1065	360	1053	430	360	150	408	390	254	237	56	98	147	189	1210	196	1001	1037
061G	1250	360	1238	430	365	157	506	495	246	235	40	83	145	188	1395	189	1186	1222
081G	1250	460	1238	530	365	157	506	495	246	235	40	83	145	188	1395	189	1186	1222
101G	1435	460	1423	530	365	157	506	495	246	235	40	83	145	188	1580	189	1371	1408
121G	1435	460	1423	530	365	157	506	495	246	235	40	83	145	188	1580	189	1371	1408

Dimensional data — TSC cabinet ceiling unit

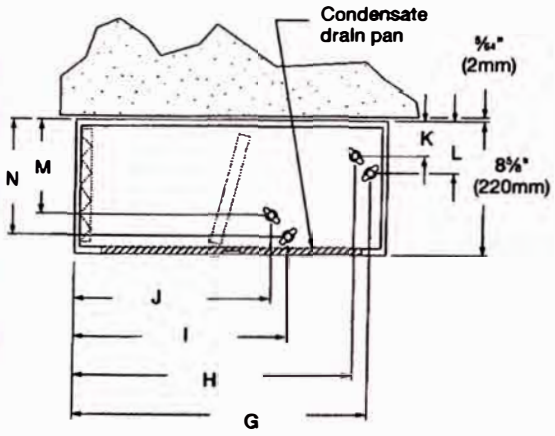
Exposed cabinet



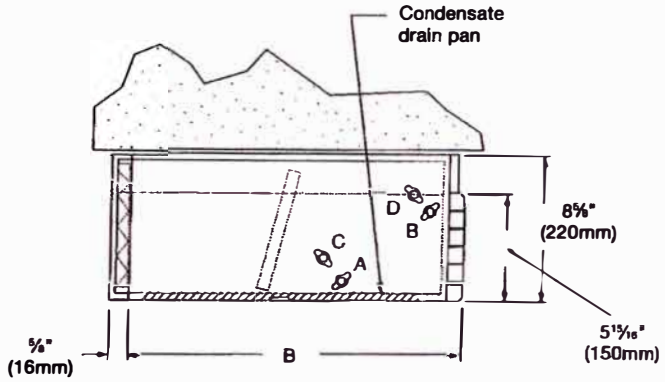
Bottom View



Ceiling Mounting



Coil Connections, Left-hand Shown



Side View

A: Auxiliary coil inlet
B: Auxiliary coil outlet
C: Main coil inlet
D: Main coil outlet

TSC UNIT SIZE	COIL CONNECTION SIZE	
	COOLING	HEATING
021G THRU 121G	⅝" (16 mm) I.D.S.	⅝" (16 mm) I.D.S.

Note: Extended (exposed) cabinets add 7¼" (185mm) to the cabinet piping end pocket.

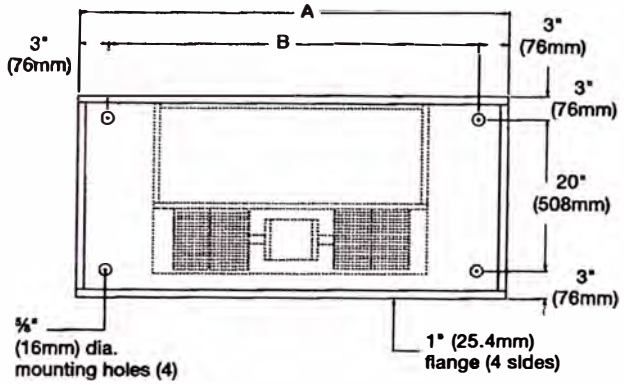
TSC SIZE	DIMENSIONS, INCHES													
	A①	B	C	D	E	F	G	H	I	J	K	L	M	N
021G	36 7/16	18⅛	26⅞	18 15/16	14 3/16	5⅞	16 1/16	15⅜	10	9 5/16	2 3/16	3⅞	5 13/16	7 7/16
031G	36 7/16	18⅛	26⅞	16 15/16	14 3/16	5⅞	16 1/16	15⅜	10	9 5/16	2 3/16	3⅞	5 13/16	7 7/16
041G	51	18⅛	41 7/16	16 15/16	14 3/16	5⅞	16 1/16	15⅜	10	9 5/16	2 3/16	3⅞	5 13/16	7 7/16
061G	58¼	18⅛	48¾	16 15/16	14 3/16	5⅞	16 1/16	15⅜	10	9 5/16	2 3/16	3⅞	5 13/16	7 7/16
081G	58¼	22 1/16	48¾	20⅞	14⅜	6 5/16	19 15/16	19½	9 11/16	9¼	1 9/16	3¼	5 11/16	7⅜
101G	65 9/16	22 1/16	56	20⅞	14⅜	6 5/16	19 15/16	19½	9 11/16	9¼	1 9/16	3¼	5 11/16	7⅜
121G	65 9/16	22 1/16	56	20⅞	14⅜	6 5/16	19 15/16	19½	9 11/16	9¼	1 9/16	3¼	5 11/16	7⅜

TSC SIZE	DIMENSIONS, MM													
	A①	B	C	D	E	F	G	H	I	J	K	L	M	N
021G	925	460	683	430	360	150	408	390	254	237	56	98	147	189
031G	925	460	683	430	360	150	408	390	254	237	56	98	147	189
041G	1295	460	1053	430	360	150	408	390	254	237	56	98	147	189
061G	1480	460	1238	430	360	150	408	390	254	237	56	98	147	189
081G	1480	560	1238	530	365	157	506	495	246	235	40	83	145	188
101G	1665	560	1423	530	365	157	506	495	248	235	40	83	145	188
121G	1665	560	1423	530	365	157	506	495	246	235	40	83	145	188

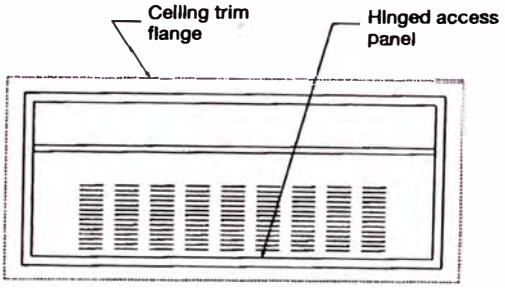
① Extended (exposed) cabinets add 7¼" (185 mm) to the cabinet length. Additional length extends the piping end pocket of the cabinet.

Dimensional data — TSC cabinet ceiling unit

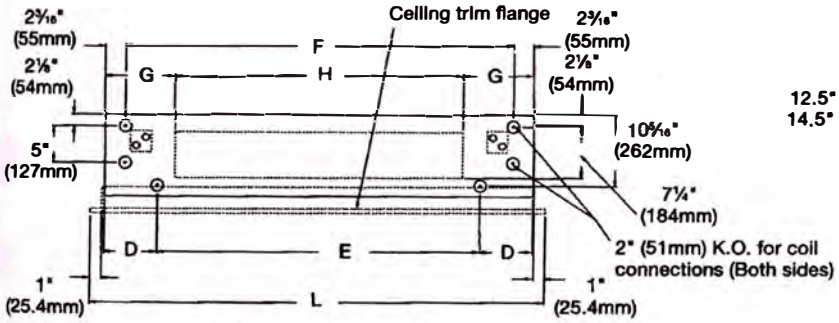
Recessed cabinet



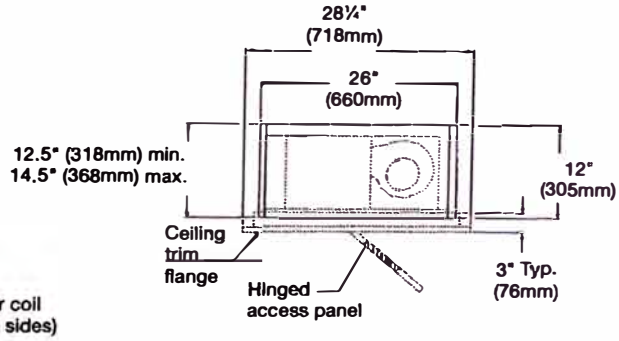
Top View



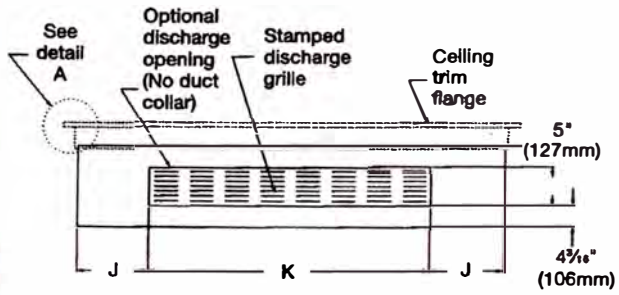
Bottom View



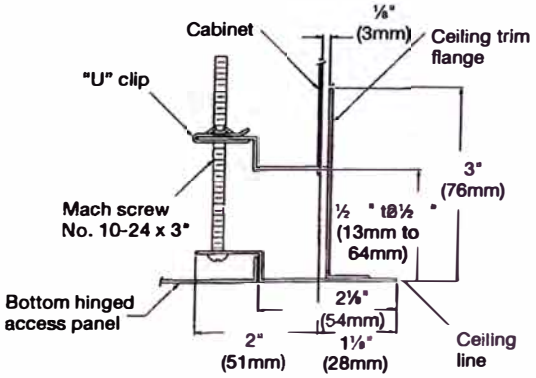
Back View (Return Air)



Side View



Front View (Discharge air)



Detail A (Side View)

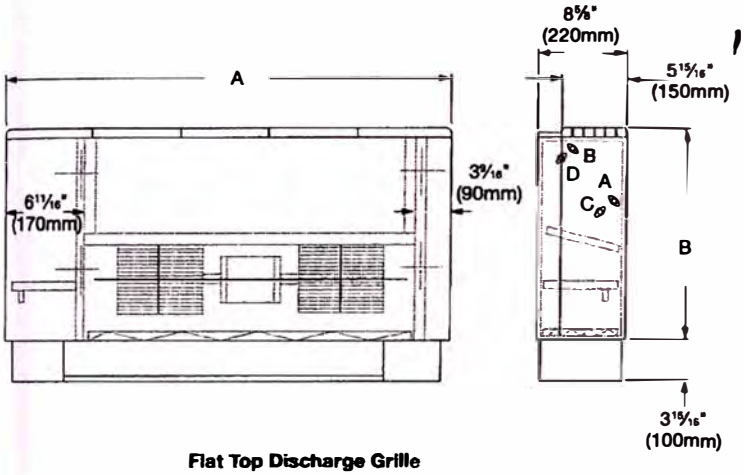
TSC UNIT SIZE	COIL CONNECTION SIZE	
	COOLING	HEATING
021G THRU 121G	⅝" (16 mm) I.D.S.	⅝" (16 mm) I.D.S.

TSC SIZE	DIMENSIONS, INCHES									
	A	B	D	E	F	G	H	J	K	L
021G	43	37	6 1⁵⁄₁₆	29 11⁵⁄₁₆	38⅝	8⅞	25¼	9⅝	23¾	45¼
031G	43	37	6 1⁵⁄₁₆	29 11⁵⁄₁₆	38⅝	8⅞	25¼	9⅝	23¾	45¼
041G	52	46	6⅜	39¼	47⅜	8⅜	35¼	6⅜	39¾	54¼
061G	78	72	6 1⁵⁄₁₆	64 11⁵⁄₁₆	73⅜	11⅜	55¼	15⅛	47¾	80¼
081G	76	72	6 1⁵⁄₁₆	64 11⁵⁄₁₆	73⅜	11⅜	55¼	15⅛	47¾	80¼
101G	78	72	6 1⁵⁄₁₆	64 11⁵⁄₁₆	73⅜	11⅜	55¼	13⅛	51¾	80¼
121G	78	72	6 1⁵⁄₁₆	64 11⁵⁄₁₆	73⅜	11⅜	55¼	13⅛	51¾	80¼

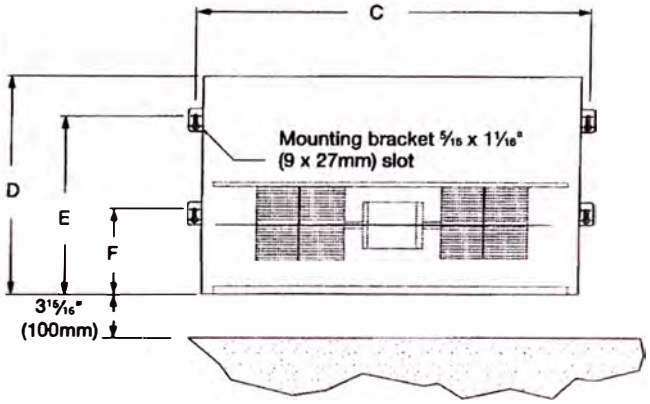
TSC SIZE	DIMENSIONS, MM									
	A	B	D	E	F	G	H	J	K	L
021G	1092	940	170	754	981	225	641	244	603	1149
031G	1092	940	170	754	981	225	641	244	603	1149
041G	1321	1168	162	997	1210	213	895	156	1010	1378
061G	1981	1829	170	1643	1870	289	1403	384	1213	2038
081G	1981	1829	170	1643	1870	289	1403	384	1213	2038
101G	1981	1829	170	1643	1670	289	1403	384	1213	2038
121G	1981	1829	170	1643	1870	289	1403	384	1213	2038

Note: Caution must be exercised when units are used with outside air as standard units are insulated on the leaving air side only. Outside fresh air must be tempered before entering the unit if freezing conditions are expected.

Dimensional data — TSF cabinet floor unit

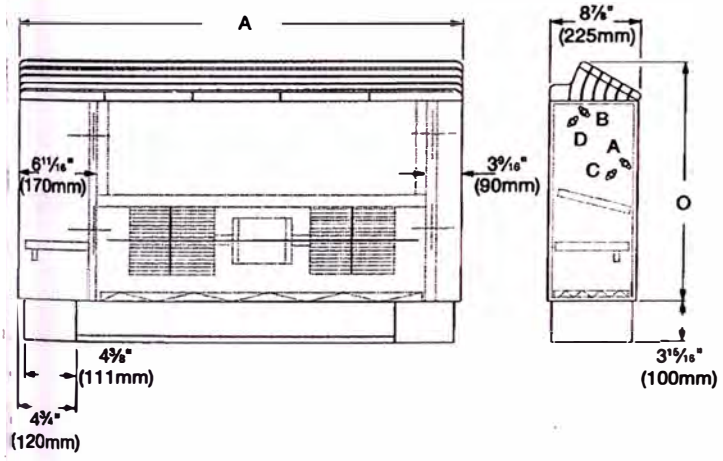


Flat Top Discharge Grille

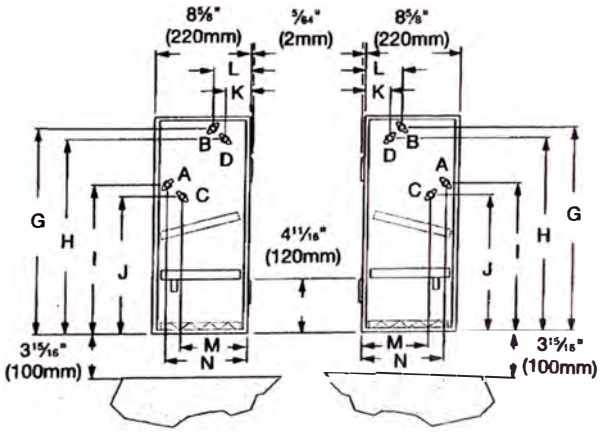


Wall Mounting

A: Auxiliary coil inlet
B: Auxiliary coil outlet
C: Main coil inlet
D: Main coil outlet



Slope Top Discharge Grille



Right-hand Coil Connections

Left-hand Coil Connections

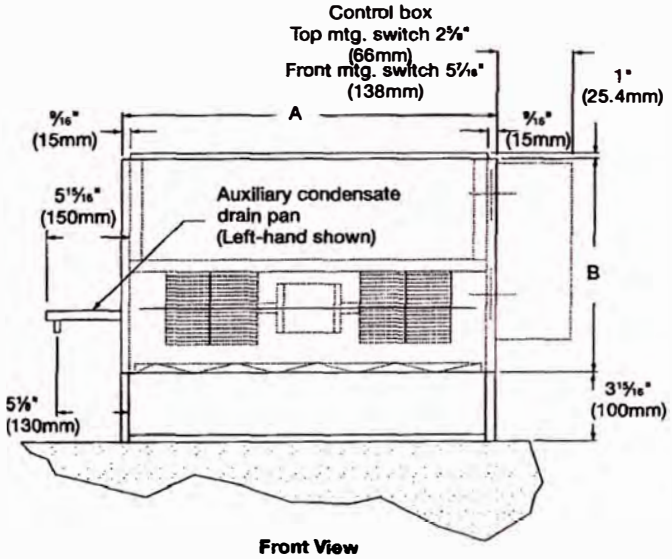
TSF UNIT SIZE	COIL CONNECTION SIZE	
	COOLING	HEATING
021G THRU 121G	⅝" (16 mm) I.D.S.	⅝" (16 mm) I.D.S.

TSF SIZE	DIMENSIONS, INCHES														
	A①	B	C	D	E	F	G	H	I	J	K	L	M	N	O
021G	36⁷⁄₁₆	18⅛	26⅞	16¹⁵⁄₁₆	14⅜	5⅞	16⅛	15⅜	10	9⅝	2⅜	3⅞	5¹³⁄₁₆	7¹⁄₁₆	20⅜
031G	36⁷⁄₁₆	18⅛	26⅞	16¹⁵⁄₁₆	14⅜	5⅞	16⅛	15⅜	10	9⅝	2⅜	3⅞	5¹³⁄₁₆	7¹⁄₁₆	20⅜
041G	51	18⅛	41⅞	16¹⁵⁄₁₆	14⅜	5⅞	16⅛	15⅜	10	9⅝	2⅜	3⅞	5¹³⁄₁₆	7¹⁄₁₆	20⅜
061G	58¼	18⅛	48¾	16¹⁵⁄₁₆	14⅜	5⅞	16⅛	15⅜	10	9⅝	2⅜	3⅞	5¹³⁄₁₆	7¹⁄₁₆	20⅜
081G	58¼	22⅛	48¾	20⅞	14⅜	6⅜	19¹⁵⁄₁₆	19½	9¹¹⁄₁₆	9¼	1⅜	3¼	5¹¹⁄₁₆	7⅜	24⅝
101G	65⅝	22⅛	56	20⅞	14⅜	6⅜	19¹⁵⁄₁₆	19½	9¹¹⁄₁₆	9¼	1⅜	3¼	5¹¹⁄₁₆	7⅜	24⅝
121G	65⅝	22⅛	56	20⅞	14⅜	6⅜	19¹⁵⁄₁₆	19½	9¹¹⁄₁₆	9¼	1⅜	3¼	5¹¹⁄₁₆	7⅜	24⅝

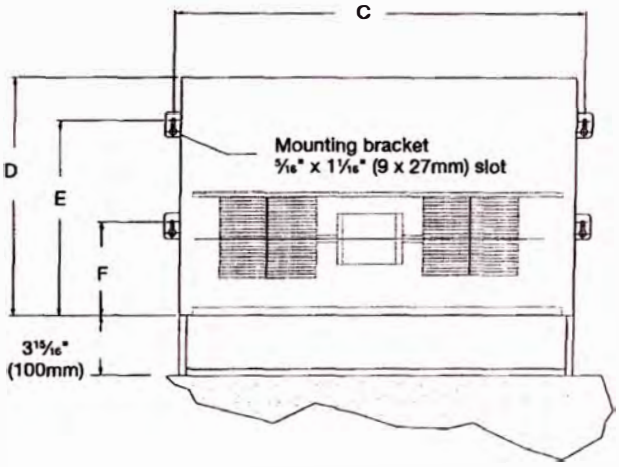
TSF SIZE	DIMENSIONS, MM														
	A①	B	C	D	E	F	G	H	I	J	K	L	M	N	O
021G	925	460	683	430	360	150	408	390	254	237	56	98	147	189	518
031G	925	460	683	430	360	150	408	390	254	237	56	98	147	189	518
041G	1295	460	1053	430	360	150	408	390	254	237	56	98	147	189	518
061G	1480	460	1238	430	360	150	408	390	254	237	56	98	147	189	518
081G	1480	560	1238	530	365	157	506	495	246	235	40	83	145	188	618
101G	1665	560	1423	530	365	157	506	495	246	235	40	83	145	188	618
121G	1665	560	1423	530	365	157	506	495	246	235	40	83	145	188	618

① Extended (exposed) cabinets add 7¼" (185 mm) to the cabinet length. Additional length extends the piping end pocket of the cabinet.

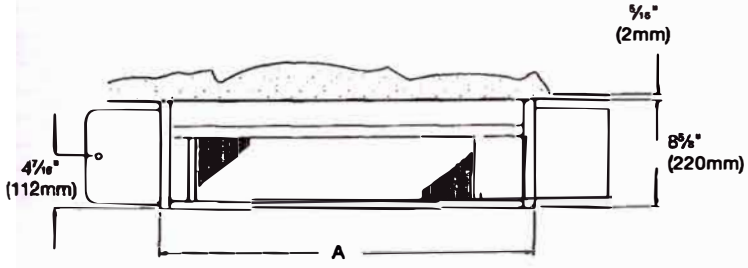
Dimensional data — TSB basic floor unit



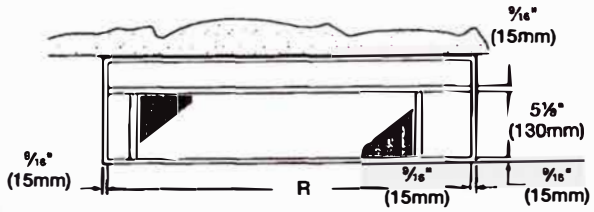
Front View



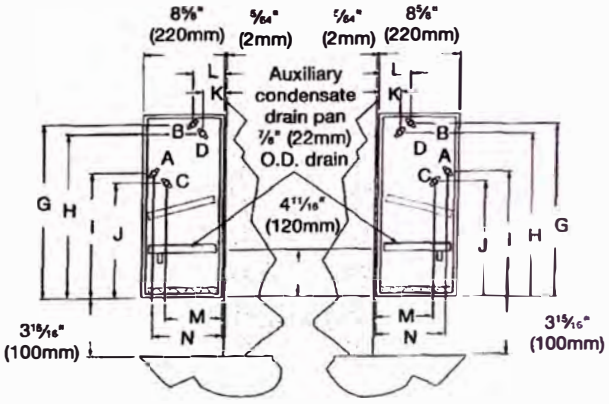
Wall Mounting



Top View



Discharge Duct Connections



Right-hand Coil Connections

Left-hand Coil Connections

TSB UNIT SIZE	COIL CONNECTION SIZE	
	COOLING	HEATING
021G THRU 121G	⅝" (16 mm) I.D.S	⅝" (16 mm) I.D.S.

A: Auxiliary coil inlet
B: Auxiliary coil outlet
C: Main coil inlet
D: Main coil outlet

TSB SIZE	DIMENSIONS, INCHES														
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	R
021G	27⅜	16 15/16	26⅞	16 15/16	14 3/16	5⅞	16 1/16	15⅜	10	9 3/16	2 3/16	3⅞	5 13/16	7 7/16	26¼
031G	27⅜	16 15/16	26⅞	16 15/16	14 3/16	5⅞	16 1/16	15⅜	10	9 3/16	2 3/16	3⅞	5 13/16	7 7/16	26¼
041G	41 15/16	16 15/16	41 7/16	16 15/16	14 3/16	5⅞	16 1/16	15⅜	10	9 3/16	2 3/16	3⅞	5 13/16	7 7/16	40 13/16
061G	49 3/16	16 15/16	48¾	16 15/16	14 3/16	5⅞	16 1/16	15⅜	10	9 3/16	2 3/16	3⅞	5 13/16	7 7/16	48⅛
081G	49 3/16	20⅞	48¾	20⅞	14⅜	6 3/16	19 13/16	19½	9 11/16	9¼	1 9/16	3¼	5 11/16	7⅜	48⅛
101G	56½	20⅞	56	20⅞	14⅜	6 3/16	19 15/16	19½	9 11/16	9¼	1 9/16	3¼	5 11/16	7⅜	57 7/16
121G	56½	20⅞	56	20⅞	14⅜	6 3/16	19 15/16	19½	9 11/16	9¼	1 9/16	3¼	5 11/16	7⅜	57 7/16

TSB SIZE	DIMENSIONS, MM														
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	R
021G	695	430	683	430	360	150	408	390	254	237	56	98	147	189	667
031G	695	430	683	430	360	150	408	390	254	237	56	98	147	189	667
041G	1065	430	1053	430	360	150	408	390	254	237	56	98	147	189	1037
061G	1250	430	1238	430	360	150	408	390	254	237	56	98	147	189	1222
081G	1250	530	1238	530	365	157	506	495	246	235	40	83	145	188	1222
101G	1435	530	1423	530	365	157	506	495	246	235	40	83	145	188	1408
121G	1435	530	1423	530	365	157	506	495	246	235	40	83	145	188	1408

Physical data

Table 11. Component data

UNIT SIZE	021G	031G	041G	061G	081G	101G	121G
COILS							
FACE AREA FT²	1.24	1.24	2.04	2.45	3.68	4.26	4.28
M²	0.115	0.115	0.190	0.228	0.341	0.396	0.398
# CIRCUITS 2-ROW	2	2	2	2	4	4	4
3-ROW	2	2	3	3	6	6	6
1-ROW	1	1	1	1	2	2	2
TUBE DIAMETER	3/8" (10 mm)						
CONNECTION DIA.	5/8" (16 mm) I.D.S.						
MAX. WORKING PRESS.	300 psig (20.7 bar)*						
FINS/INCH	16						
FIN MATERIAL	Aluminum						
AIR VENT	Manual						
FANS							
WHEEL QUANTITY	1	1	2	2	3	3	3
DIA. X WIDTH	5¾" x 8½" (146 mm x 216 mm)			5¾" x 9⁷⁄₁₆" (146 mm x 240 mm)			
WHEEL TYPE	DWDI						
WHEEL MATERIAL	Aluminum						
MOTOR QUANTITY	1	1	1	1	3	3	3
MOTOR HP	1/30	1/25	1/20	1/20	1/20	1/12	1/6
FILTERS (CLEANABLE)							
QUANTITY	1	1	1	1	1	1	1
HEIGHT	8⅛" (205 mm)						
WIDTH INCH	26	26	40⁹⁄₁₆	47¹³⁄₁₆	47¹³⁄₁₆	55⅛	55⅛
MM	660	660	1030	1215	1215	1400	1400

*Some value package components will handle a maximum working pressure of 200 psig (13.8 bar).

Shipping weights

Table 12. Approximate shipping weights

MODEL	UNIT SIZE						
	021G	031G	041G	061G	081G	101G	121G
TSH							
LBS.	42	42	66	73	99	110	110
KG	19	19	30	33	45	50	50
TSC (EXPOSED CABINET)							
LBS.	55	55	82	90	117	130	130
KG	25	25	37	41	53	59	59
TSC (RECESSED CABINET)							
LBS.	107	110	131	149	173	217	217
KG	49	50	59	68	78	98	98
TSF							
LBS.	53	53	79	88	115	128	128
KG	24	24	36	40	52	58	58
TSB							
LBS.	40	40	64	71	97	108	108
KG	18	18	29	32	44	49	49

Note: Approximate weights do not include valve packages, hot water coils, electric heaters or other options

Engineering guide specifications — ceiling units

Furnish and install where shown on the plans and specifications, McQuay (horizontal hideaway unit)(ceiling exposed unit)(ceiling recessed unit) ThinLine SeasonMaker fan-coil units. Models, sizes and performance shall be tabulated in the schedule. Unit performance shall be substantiated by computer generated output data. Each unit shall be ARI certified and consist of and comply with the following:

Chassis and cabinets

Ceiling hideaway unit (TSH) — Unit shall consist of a base chassis with return air and discharge air duct collars fabricated of heavy-gauge galvanized steel for ease of connecting ductwork. The chassis shall be insulated to prevent the unit from sweating. Return air duct collar shall have a filter frame for a cleanable filter with filter access from the bottom or side of the collar.

Ceiling exposed cabinet unit (TSC) — Unit shall consist of basic chassis enclosed in an attractive heavy-gauge steel cabinet finished with an electrostatically applied, baked-on Antique Ivory paint. Cabinet shall have a (high impact polymer)(stamped metal) horizontal discharge grille with return air through the (rear grille)(bottom grille)(rear duct opening). Cabinet shall be hinged for service access as standard.

Ceiling recessed cabinet unit (TSC) — Unit shall consist of basic chassis enclosed in an attractive heavy-gauge steel cabinet finished with an electrostatically applied, baked-on Antique Ivory paint. Cabinet shall have a (stamped hor-izontal discharge grille)(discharge opening) with return air through the (bottom grille)(rear grille)(rear duct opening). Cabinet shall include a bottom hinged access panel as standard.

Single power location — Unit shall have a single power location providing a single location for all field wiring connections. All factory mounted electrical components shall have wire leads terminating in the single location.

Coils — Coils shall have aluminum fins with copper tubes mechanically expanded for a permanent bond. Coils shall have a (manual) air vent. Unit performance shall be as tabulated in the schedule.

Fan assembly — Fans shall be DWDI forwardly curved, centrifugal type. Fan housing shall be fabricated of heavy-gauge galvanized steel.

Motors — Units shall have (115/60/1)(277/60/1) three-speed, sleeve bearing, permanent split capacitor motors with oilers, inherent thermal overload protection with automatic reset and resilient mounts.

Drain pan — Drain pan shall be constructed of heavy-gauge galvanized steel, insulated with high density closed cell foam insulation.

Insulation — Ceiling exposed TSC model shall be insulated with high density closed cell insulation on the exterior of the drain pan and on the top, sides of the chassis. Ceiling recessed model TSC shall be insulated with high density closed cell foam on the (bottom panel only) (Bottom, sides, top and front panels). Hideaway TSH chassis shall be insulated with high density closed cell foam insulation.

Filters — Filters shall be cleanable type.

Optional accessories

Electric heat — Units shall be provided with (115/60/1)(277/60/1) electric heat. Heaters shall be fully protected by a high-limit thermal cut-out with automatic reset. The electric heat control system shall incorporate a fan interlock permitting heating elements to operate only when the fan motor is energized. All electric heat controls are to be unit mounted, wired and enclosed by the unit manufacturer at the factory. All models shall have fully sheathed heating elements located on the leaving air side of the cooling coil.

Valve packages — Valve packages shall consist of 2-or 3-way motorized electric valves with gate hand on supply and ball hand valve on return piping. Two-way motorized valve packages shall have bypass capillary tubes to provide minimal flow to enable automatic changeover aquastats, where required, to sense system water temperature.

Engineering guide specifications — floor units

Furnish and install where shown on the plans and specifications, McQuay (floor unit)(basic unit) ThinLine SeasonMaker fan-coil units. Models, sizes and performance shall be tabulated in the schedule. Unit performance shall be substantiated by computer generated output data. Each unit shall be ARI certified and consist of and comply with the following:

Casing and cabinets

Flat top floor unit (TSF) — Cabinet shall be a vertical console type enclosure fabricated of heavy-gauge steel and finished with a electrostatically applied, baked-on Antique Ivory paint. Cabinet shall include a (high impact polymer)(stamped metal) discharge grille in the top panel and electrical and piping end compartments.

Slope top floor unit (TSF) — Cabinet shall be a vertical console type enclosure fabricated of heavy-gauge steel and finished with an electrostatically applied, baked-on Antique Ivory paint. Cabinet shall include a discharge grille providing optimal air discharge and full width electrical and piping end compartments. The discharge grille shall be made of (high impact polymer)(stamped metal).

Basic unit (TSB) — Basic unit shall consist of chassis and removable front panel fabricated of heavy-gauge galvanized steel with (top duct)(front) discharge opening for installation in custom enclosure furnished by contractor.

Basic unit with wall plates (TSB) — Basic unit shall consist of chassis fabricated of heavy-gauge galvanized steel with (top duct)(front) discharge. Wall plates shall be fabricated of 18-gauge steel, finished with an electrostatically applied, baked-on Antique Ivory paint. Wall plates shall include (stamped discharge grille), access door and return air grille.

Electrical box — Unit shall have an electrical box providing a single location for all field wiring connections. All factory mounted electrical components shall have wire leads terminating in the unit electrical box.

Coils — Coils shall have aluminum fins with copper tubes mechanically expanded for a permanent bond. Coils shall have a (manual)(automatic) air vent. Coil performance shall be as tabulated in the schedule.

Fan assembly — Fans shall be DWDI forwardly curved, centrifugal type. Fan housing shall be fabricated of heavy-gauge galvanized steel.

Motors — Units shall have (115/60/1)(277/60/1) three-speed, sleeve bearing, permanent split capacitor motors with oilers, inherent thermal overload protection with automatic reset and resilient mounts.

Speed control — Units shall have a (unit)(wall) mounted three-speed switch with integral on/off switch which shall provide high/medium/low fan speed control.

Drain pan — Primary drain pan shall be constructed of heavy-gauge galvanized steel, and insulated with closed cell insulation. Secondary drain pan shall be constructed of injection molded polystyrene and be equipped with a drain suitable to receive a ½" (13mm) PVC socket elbow or coupling.

Insulation — Cabinet insulation shall be high density closed cell foam insulation.

Filters — Filters shall be cleanable type.

Optional accessories

Electric heat — Units shall be provided with (115/60/1)(277/60/1) electric heat. Heaters shall be fully protected by a high-limit thermal cut-out with automatic reset. The electric heat control system shall incorporate a fan interlock permitting heating elements to operate only when the fan motor is energized. All electric heat controls are to be unit mounted, wired and enclosed by the unit manufacturer at the factory. All models shall have fully sheathed elements located on the leaving air side of the cooling coil.

Valve packages — Valve packages shall consist of 2- or 3-way motorized electric valves with gate hand valve on supply and ball hand valve on return piping. Two-way motorized valve packages shall have bypass capillary tubes to provide minimal flow to enable automatic changeover aquastats, where required, to sense system water temperature.

Fresh air kit — A (manual)(automatic motorized) fresh air intake damper shall be provided by the unit manufacturer for (factory)(field) installation.

Tamperproof access door — Units shall be provided with tamperproof access door on the control box compartment.

Aluminum wall box — An aluminum wall box with two sets of louvers shall be provided by the unit manufacturer for field installation into the outside wall of the building.

Computer fan-coil selection program

To provide optimal fan-coil unit selection, McQuay International provides SelectTools™ Fan-coil microcomputer fan-coil selection capability. The computer program will select the most economical unit size and coil option to meet the specification. The program capabilities include hot and chilled water, hot and chilled water with glycol, electric heat, and unit external static pressure.

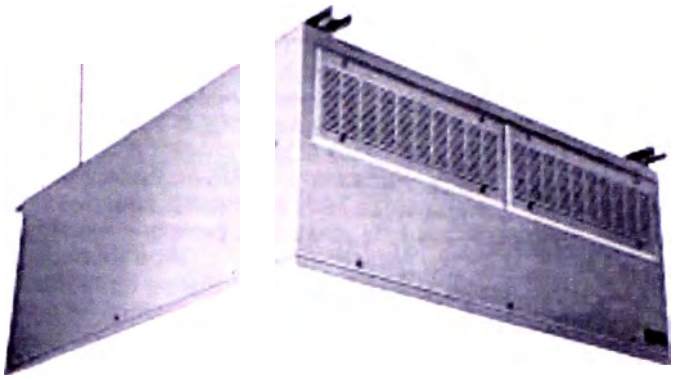
To operate the SelectTools™ Fan-coil software the user needs a microcomputer using Windows 3.1 or higher. McQuay will provide the software to run the fan-coil selection. Contact your McQuay representative for a fan-coil selection that meets the most exacting specifications.

Contact your McQuay representative today.

McQuay International

13600 Industrial Park Boulevard, P.O. Box 1551, Minneapolis, MN 55440 USA (612) 553-5330

Catalog 735-2

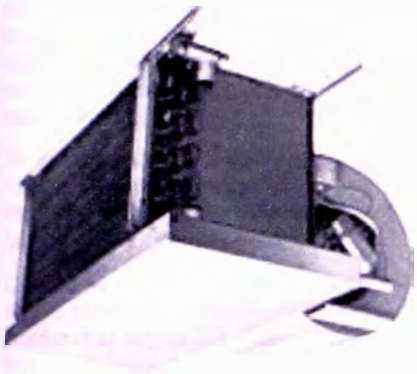


Large Capacity Fan-coil Units

Type SCB, SHB SCD, SHD

McQuay
Air Conditioning

McQuay SeasonMaker Large Capacity Fan-coil Units



SHD DIRECT DRIVE HIDEAWAY UNIT

Type SHD direct drive hideaway unit

The SHD hideaway unit is designed for installation in a fully concealed ceiling location. These units will deliver the desired air volumes against a wide range of external static pressures encountered with varying duct layouts. Unit features include:

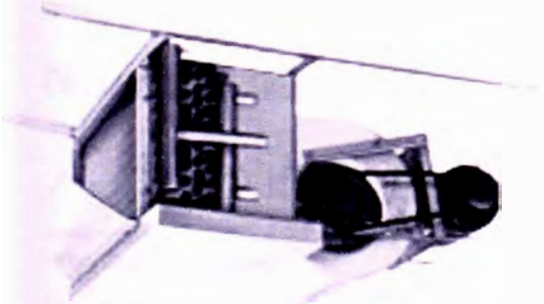
- 5 unit sizes from 600 to 2000 nominal cfm.
- Heavy-gauge galvanized steel basic cabinet.
- Vertically mounted standard or high capacity water and evaporator coils.
- Multi-speed permanent split capacitor motors.
- High performance, large diameter forward curved centrifugal fan wheels.
- Full width drain pan, fully insulated.
- Optional return air plenums and heating coils.
- U.L. safety agency listing.

SCD DIRECT DRIVE CEILING UNIT

Type SCD direct drive ceiling unit

The SCD ceiling unit is designed for ceiling suspension in the conditioned space or installation in a fully concealed location. Unit features include all of the features listed above for the SHD unit plus the following:

- 5 unit sizes from 600 to 2000 nominal cfm.
- Heavy-gauge galvanized steel decorative cabinet with discharge grille or duct collar.
- Attractive Mist Gray electrostatically applied, baked-on finish.
- Cabinet completely insulated with 1" neoprene coated glass fiber.
- Removable bottom and side panels.
- Two-inch throwaway filter.
- U.L. safety agency listing.



SHB BELT DRIVE HIDEAWAY UNIT

Type SHB belt drive hideaway unit

The SHB hideaway unit is designed for installation in a fully concealed ceiling location. These units incorporate all of the money-saving installation features of smaller direct drive fan coils plus the flexibility and performance of large belt drive air handling units. Unit features include:

- 5 unit sizes from 800 to 3000 nominal cfm.
- Heavy-gauge galvanized steel basic cabinet.
- Vertically mounted standard or high capacity water and evaporator coils.
- Wide variety of standard belt duty motor voltages and horsepowers.
- High performance, large diameter forward curved centrifugal fan wheels.
- Solid steel fan shafts with permanently lubricated, resiliently mounted, self-aligning ball bearings.
- Full width drain pan, fully insulated.
- Optional return air plenums and heating coils.

SCB BELT DRIVE CEILING UNIT

Type SCB belt drive ceiling unit

The SCB ceiling unit is designed for ceiling suspension in the conditioned space or installation in a fully concealed location. Unit features include all of the features listed above for the SHB unit plus the following:

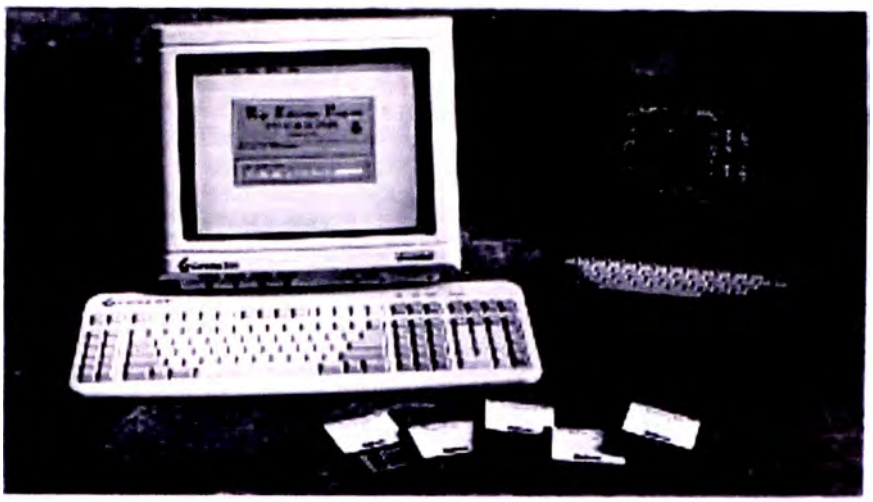
- 5 unit sizes from 800 to 3000 nominal cfm.
- Heavy-gauge galvanized steel decorative cabinet with discharge grille or duct collar.
- Attractive Mist Gray electrostatically applied, baked-on finish.
- Cabinet completely insulated with 1" neoprene coated glass fiber.
- Removable bottom and side panels.
- Two-inch throwaway filter.

Computer fan-coil selection program

MS-85™ microcomputer fan-coil selection capability is available from McQuay International to provide optimal fan-coil selection. The computer program will select the most economical unit size and coil option to meet the specification. The program capabilities include hot and chilled water, hot and chilled water with glycol, steam, and unit external static pressure.

To operate the MS-85™ software the user needs a microcomputer using MS/DOS. McQuay will provide the software to run the fan-coil selection program.

Contact your nearest representative for a copy of the MS-85™ software or for a fan-coil selection that meets the most exacting specifications.



Contents

Nomenclature

S C B - 08 1 B

SeasonMaker™
Large Capacity Fan coil

Type of unit
C - Cabinet
H - Hideaway

Fan Drive
B - Belt Drive
D - Direct Drive

Design Vintage

Application Series

Unit Size
Nominal CFM in 100s
(08 = 800 CFM, etc.)

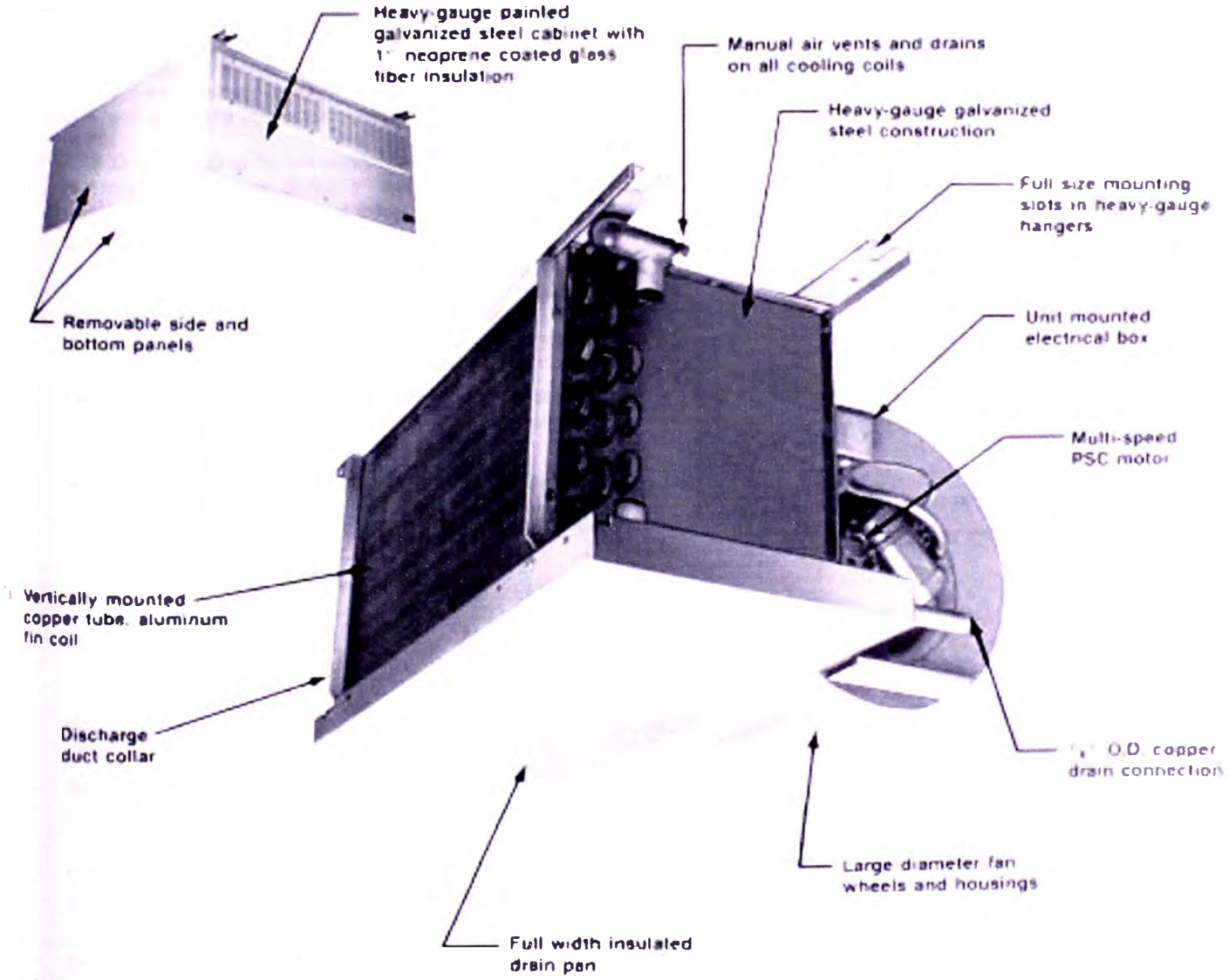
Bulletin illustrations cover the general appearance of McQuay international products at the time of publication and we reserve the right to make changes in design and construction at any time without notice.

Design features — SHD & SCD direct drive units

SHD hideaway type and SCD cabinet type large capacity SeasonMaker fan-coil units are available for concealed installations or ceiling suspension within the conditioned space. Cooling, heating, dehumidifying and air filtering are combined in a single, compact unit. A full line of optional accessories makes these units completely versatile in application.

Large capacity SeasonMaker fan-coil units increase the design range of fan-coil systems by eliminating the unit size limitations and retaining all of the economy features. These units are designed to deliver the rated capacity against normal external static pressures, and may be installed for either "free" or "ducted" air delivery. Large diameter, direct drive, centrifugal fans and permanent split capacitor motors assure quiet operation with minimum power consumption.

Speed control is achieved with lap-wound motors. A three-speed control switch with off position is supplied to provide simple adjustment of the unit output to maintain desired comfort conditions. Properly matched components, high quality construction, and thorough testing are your assurance of long life and dependable performance with a minimum of operating and maintenance costs.



Quality, efficiency and reliability are built into every unit.

Dependable, trouble-free performance

Casing and cabinet. SHD and SCD frame members and basic casing are constructed of continuous galvanized steel.

SCD unit cabinets are continuous galvanized steel, finished with a Mist Gray oven-cured paint. One inch of neoprene coated glass fiber insulation is installed internally to protect against corrosion and sweating and provides a sound absorbing, acoustic barrier. Side and bottom panels are removable to facilitate installation and maintenance.

Coils. All coils are constructed of seamless copper tubes and headers with aluminum fins. Full depth collars, drawn in the fin stock, provide accurate control of fin spacing and completely cover the copper tubes to lengthen coil life. Tubes are mechanically expanded into the fins for a permanent primary-to-secondary surface bond, assuring maximum heat transfer efficiency. Standard and high capacity water coils are furnished with manual air vents and drain plugs.

Direct expansion evaporator coils, complete with a distributor, are available in standard and high capacity configurations.

SHD and SCD units are available with separate one- and two-row heating coils, in the reheat position, for either hot water or steam application in a four-pipe system.

Drain pans. The SHD and SCD primary drain pans are constructed of continuous galvanized steel, insulated with closed cell insulation and sealed with mastic to provide maximum protection against corrosion and sweating. The SCD unit has a secondary drain pan to collect condensate from field supplied valves. Drain pans must be trapped in the field.

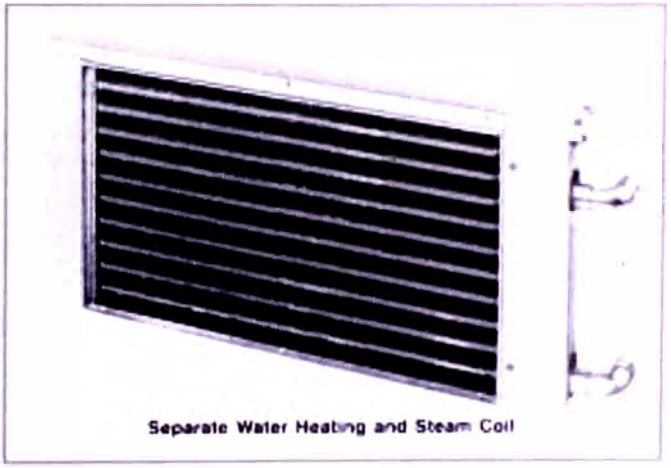
Fans. Large diameter, forwardly curved, double width, double inlet centrifugal fans are statically and dynamically balanced to assure smooth, quiet operation.

Motor and drive. Motors are permanent split capacitor type with oilers and inherent thermal overload protection with automatic reset. Motors are resiliently mounted with the fan directly connected to the motor shaft. Motors are available for 115/60/1, 277/60/1 and 230/50/1 electric service.

Speed control. Speed control is obtained by means of tap-wound motors with four taps. A three-speed control switch with off position and wall plate is furnished for installation by the contractor in a standard 2 × 4-inch junction box. The speed switch can be wired to any three of the four motor taps to provide air delivery in three increments from 100% to 50% of rated airflow.

Air discharge. SCD units are furnished with a removable stamped discharge grille. SHD units are provided with a duct collar to facilitate installation.

Filters. SCD units are provided with 2" throwaway filters which are easily removed through the bottom of the filter holding frame. The optional return air plenum for SHD units accommodates a 2" filter.



Separate Water Heating and Steam Coil

Optional features for application flexibility

Secondary drain pan. A secondary drain pan to collect condensate from valve and piping manifolds of the SHD unit is available for field mounting.

Double deflection grilles. Double deflection grilles, with a double set of airfoil louvers (front set parallel to the long dimension and rear set parallel to the short dimension) allow full adjustment for any degree of deflection in both vertical and horizontal planes.

Discharge duct collar. A ¾" duct collar in lieu of a stamped discharge grille is available factory mounted to SCD units to facilitate duct connections.

Return air plenum. Provides a complete galvanized steel enclosure around fans and motors and simplifies duct connections on SHD units. It is available for either back or bottom return air with a 2" filter frame on the return air opening. Plenums are insulated with 1" neoprene coated glass fiber.

Filters. SCD cabinet units and SHD hideaway units with plenums ship with 2" throwaway filters as standard. Cleanable filters are also available for SHD plenums. SCD units accept standard commercial throwaway and cleanable filter sizes.

Vibration isolators. Rubber-in-shear vibration isolation elements are available for field mounting on all large capacity units.

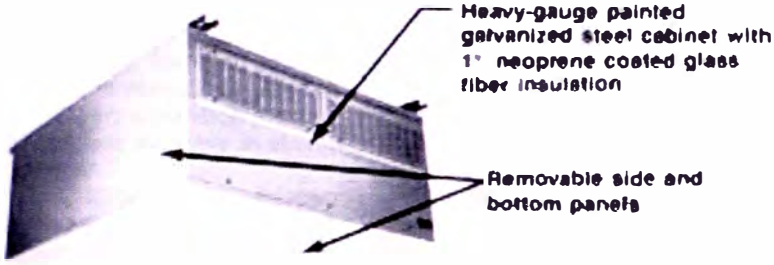
SHD Unit With Return Air Plenum

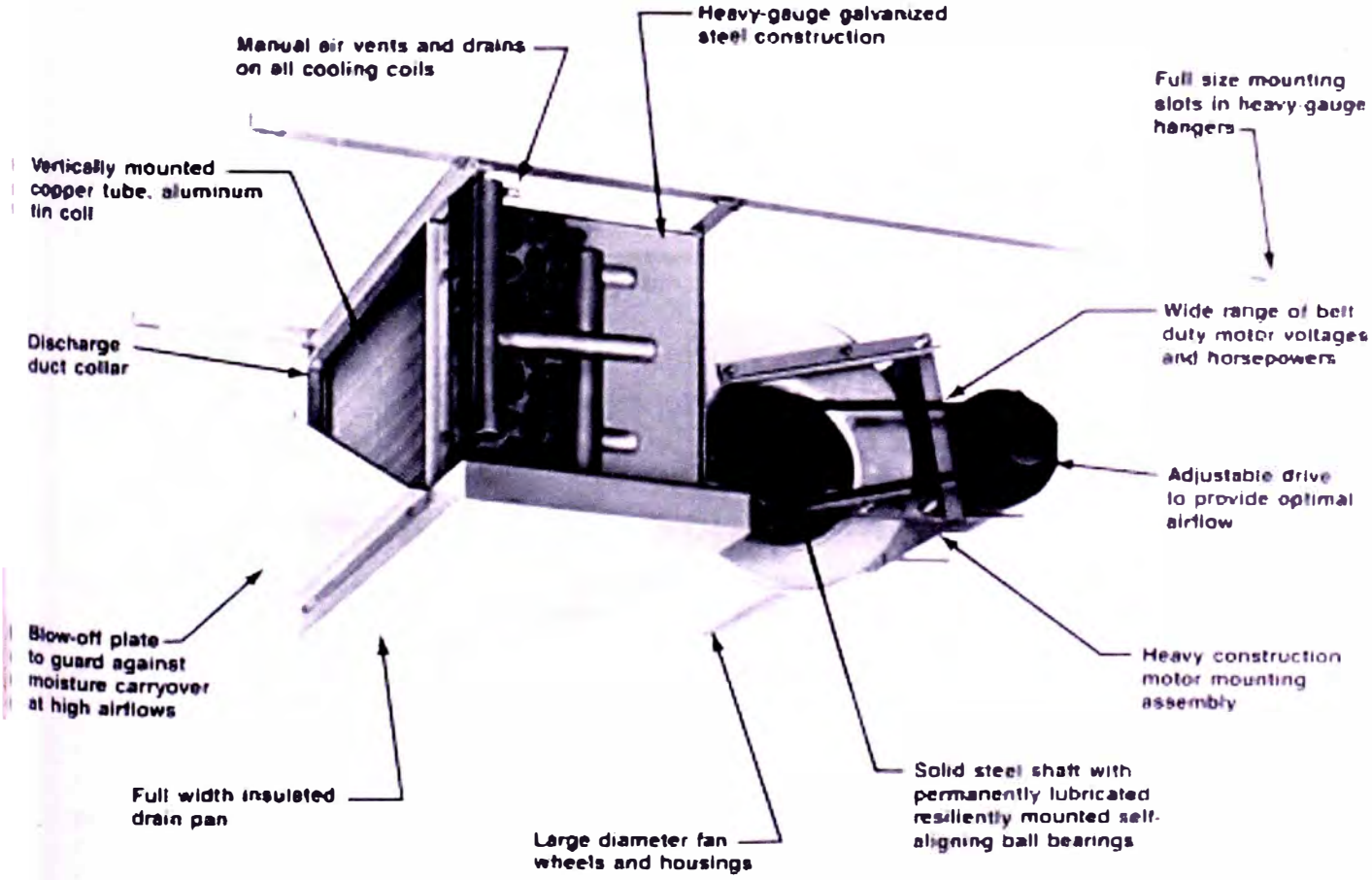
Design features — SHB & SCB belt drive units

SHB hideaway type and SCB cabinet type large capacity SeasonMaker fan-coil units are available for concealed installations or ceiling suspension within the conditioned space. Cooling, heating, dehumidifying and air filtering are combined in a single, compact unit. A full line of optional accessories makes these units completely versatile in application.

These units are designed to deliver the rated capacity against normal external static pressures, and may be installed for either "free" or "ducted" air delivery. Forward curved, double inlet, centrifugal fans provide low sound level operation.

Properly matched components, high quality construction and thorough testing assure a simple, trouble-free installation and long life with a minimum of operating and maintenance costs.





Performance flexibility of a central station air handler with the compactness of a fan-coil unit.

Heavy construction for exceptional reliability

Casing and cabinet. SHB and SCB frame members and basic casing are constructed of continous galvanized steel.

SCB unit cabinets are continuous galvanized steel, finished with a Mist Gray oven-cured paint. One inch of neoprene coated glass fiber insulation is installed internally to protect against corrosion and sweating and provides a sound absorbing, acoustic barrier. Side and bottom panels are removable to facilitate installation and maintenance.

Coils. All coils are constructed of seamless copper tubes and headers with aluminum fins. Full depth collars, drawn in the fin stock, provide accurate control of fin spacing and completely cover the copper tubes to lengthen coil life. Tubes are mechanically expanded into the fins for a permanent primary-to-secondary surface bond, assuring maximum heat transfer efficiency. Standard and high capacity water coils are furnished with manual air vents and drain plugs.

Direct expansion evaporator coils, complete with a distributor, are available in standard and high capacity configurations.

SHB and SCB units are available with separate one- and two-row heating coils, in the reheat position, for either hot water or steam application in a four-pipe system.

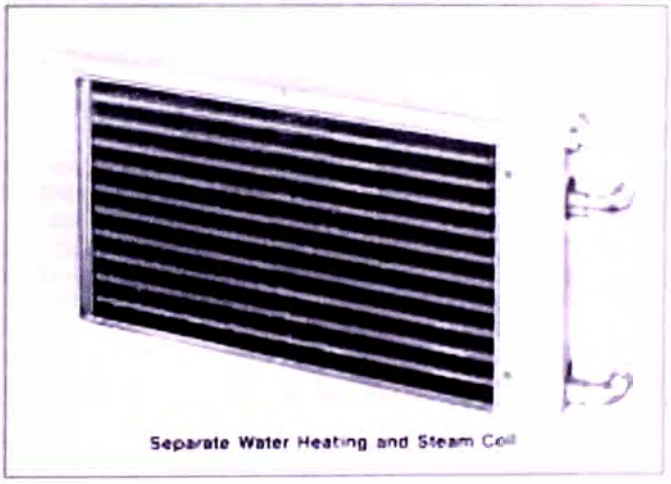
Drain pans. The SHB and SCB primary drain pans are constructed of continuous galvanized steel, insulated with closed cell insulation and sealed with mastic to provide maximum protection against corrosion and sweating. The SCB unit has a secondary drain pan to collect condensate from field supplied valves. Drain pans must be trapped in the field.

Fans. Large diameter, forwardly curved, double width, double inlet centrifugal fans are statically and dynamically balanced to assure smooth, quiet operation. Fan wheels are mounted on a solid-steel shaft. Fan bearings are permanently lubricated, resiliently mounted, self-aligning ball bearings.

Motor and drive. Standard belt duty, 1800 nominal RPM, open drip-proof motors are bolted to an adjustable platform to facilitate belt adjustment. Belt duty motors are available in a wide range of voltages and horsepowers or can be field provided by others. Variable pitch motor sheave is furnished as standard for ease and accuracy in balancing the system.

Air discharge. SCB units are furnished with a removable, stamped discharge grille. SHB units are provided with a duct collar to facilitate installation.

Filters. SCB units are provided with 2" throwaway filters which are easily removed through the bottom of the filter holding frame. The optional return air plenum for SHB units accommodates a 2" filter.



Separate Water Heating and Steam Coil

Optional features for application flexibility

Secondary drain pan. A secondary drain pan to collect condensate from valve and piping manifolds of the SHB unit is available for field mounting.

Double deflection grilles. Double deflection grilles, with a double set of airfoil louvers (front set parallel to the long dimension and rear set parallel to the short dimension) allow full adjustment for any degree of deflection in both vertical and horizontal planes.

Discharge duct collar. A ¾" duct collar in lieu of a stamped discharge grille is available factory mounted to SCB units to facilitate duct connections.

Return air plenum. Provides a complete galvanized steel enclosure around fans and motors and simplifies duct connections on SHB units. It is available for either back or bottom return air with a 2" filter frame on the return air opening. Plenums are insulated with 1" neoprene coated glass fiber.

Filters. SCB cabinet and SHB hideaway units with plenums ship with 2" throwaway filters as standard. Cleanable filters are available for SHB plenums. SCB units accept standard commercial throwaway and cleanable filter sizes.

Vibration isolators. Rubber-in-shear vibration isolation elements are available for field mounting on all large capacity units.

SHB Unit With Return Air Plenum

Unit selection

Unit Selection

General — The achievement of an efficient fan-coil system is dependent upon accurate system design and proper equipment selection. Variations, limitations and control of fan-coil systems, design conditions and design load calculations are not described in detail in this catalog. More detailed information may be found in the ASHRAE Guide. This catalog contains application ratings for large capacity SeasonMaker fan-coil units from which the design engineer can make unit selections to meet the requirements of the system.

Basic Design Data — Prior to selecting the individual unit sizes, the design engineer must fix or determine the following factors:

1. Inside and outside wet and dry bulb temperatures.
2. Method of introducing the ventilation.
3. Wet and dry bulb temperatures of the air mixture entering the unit coil.
4. Total and sensible heat gains and losses of the area to be served.
5. Properties of the heating and cooling mediums.
6. Available electric power service.
7. Any special design requirements of the building or system.

Selection of Unit Size

The capacity ratings presented in this catalog are provided for initial unit selection only. Unit size selection should be determined by using the McQuay MS-85 Fan-coil Selection Computer Program. Water cooling and heating capacities, unit airflow, static pressure, and glycol solutions are incorporated into the program to provide the best possible selection. Consult your McQuay representative for a copy of the software or a selection tailored to your application.

Cooling Coil Requirements — Having checked the minimum unit size to meet the ventilation requirement, the unit size is generally selected on the basis of matching the sensible cooling capacity of the unit at high speed to the calculated requirements.

The initial unit selection should be checked for air volume in the design system and the cooling capacities checked at the actual operating conditions. While units selected on the basis of sensible load will generally meet the total cooling load, total load should be checked in all cases.

Two Water Coil Types — Standard and high capacity coil types are available for all unit sizes to permit unit selections for optimum performance.

Two Direct Expansion Coil Types — Standard and high capacity coil types are available for all unit sizes and ship complete with distributors. For direct expansion coil capacities at conditions other than those listed in this catalog, consult the direct expansion supplement to this catalog.

Heating Requirements — Heating requirements for two-pipe systems are generally met by employing the same water flow rate as cooling and adjusting the entering hot water temperature to obtain a matching unit heat output at low fan speed. Four-pipe systems are generally designed by specifying a design hot water temperature and adjusting the flow rate through the separate heating coil to meet the required heat load with the fan operating at low speed.

For applications where outside air is ducted to the unit, the fresh air must be tempered before entering the unit if freezing conditions can be expected.

Water cooling coil ratings — direct drive units

Table 1. Standard coil water cooling capacity ratings ①

UNIT TYPES	SIZE	COOLING CAPACITY ②		WATER FLOW (GPM)	WATER P.D. (FT. W.C.)
		TOTAL BTUH	SENSIBLE BTUH		
SCD, SHD	061B	17,600	14,500	3.5	3.7
SCD, SHD	081B	26,000	19,700	5.2	3.5
SCD, SHD	121B	37,000	26,800	7.4	8.1
SCD, SHD	161B	53,100	40,000	10.6	3.2
SCD, SHD	201B	61,000	48,600	12.2	3.2

① Cooling capacities based on 80°F DB/67°F WB entering air, 45°F entering water, 10°F water temperature rise in SHD unit with plenum operating at high fan speed with no external static pressure. See Tables 15 and 16 for air volume capacities.
② For cooling coil capacity ratings at conditions other than those listed, refer to the MS-85 Computer Selection Program or consult your McQuay representative.

Table 2. High capacity coil water cooling capacity ratings ①

UNIT TYPES	SIZE	COOLING CAPACITY ②		WATER FLOW (GPM)	WATER P.D. (FT. W.C.)
		TOTAL BTUH	SENSIBLE BTUH		
SCD, SHD	061B	22,500	17,100	4.5	13.3
SCD, SHD	081B	31,700	23,100	6.3	8.1
SCD, SHD	121B	43,700	30,800	8.7	11.6
SCD, SHD	161B	64,500	47,100	12.9	11.6
SCD, SHD	201B	79,000	56,200	15.8	10.5

① Cooling capacities based on 80°F DB/67°F WB entering air, 45°F entering water, 10°F water temperature rise in SHD unit with plenum operating at high fan speed with no external static pressure.
② For cooling coil capacity ratings at conditions other than those listed, refer to the MS-85 Computer Selection Program or consult your McQuay representative.

Direct expansion coil ratings — direct drive units

Table 3. Direct expansion coil water cooling capacity ratings ①

UNIT TYPES	SIZE	STD. DX COIL COOLING CAPACITY		HI-CAP. DX COIL COOLING CAPACITY	
		TOTAL BUTH	SENSIBLE BTUH	TOTAL BTUH	SENSIBLE BTUH
SCD, SHD	061B	16,430	12,535	24,152	17,549
SCD, SHD	081B	22,260	16,157	29,680	20,687
SCD, SHD	121B	31,415	30,200	40,565	23,381
SCD, SHD	161B	43,995	32,648	58,660	41,888
SCD, SHD	201B	55,224	41,340	74,340	52,260

① Direct expansion coil ratings based on 80°F DB/67°F WB entering air and 45°F refrigerant suction temperature in SHD unit with plenum operating at high fan speed with no external static pressure. DX coils include distributor but all other refrigerant accessories such as capillary tubes, expansion valves, sightglasses, solenoid valves, strainers, etc., must be furnished and mounted by others. For direct expansion cooling coil ratings at conditions other than those listed, refer to the direct expansion unit selection manual supplement to this catalog.

Water heating & steam coil ratings — direct drive

Table 4. Standard coil water heating capacity ratings ①

UNIT TYPES	SIZE	HEATING CAPACITY (SENSIBLE BTUH)	WATER FLOW (GPM)	WATER P.D. (FT. W.C.)
SCD, SHD	061B	49,822	3.4	2.7
SCD, SHD	081B	61,724	4.2	1.9
SCD, SHD	121B	86,033	5.9	4.1
SCD, SHD	161B	126,962	8.7	1.7
SCD, SHD	201B	148,294	10.1	1.8

① Heating capacities based on 70°F DB entering air , 180°F entering water, 30°F water temperature drop in SHD unit with plenum operating at high fan speed with no external static pressure. See tables 15 and 16 for air volume capacities. For heating coil capacity ranges at conditions other than those listed, refer to the MS-85 Computer Selection Program or consult your representative.

Table 5. High capacity coil water heating capacity ratings ①

UNIT TYPES	SIZE	HEATING CAPACITY (SENSIBLE BTUH)	WATER FLOW (GPM)	WATER P.D. (FT. W.C.)
SCD, SHD	061B	63,006	4.3	9.4
SCD, SHD	081B	78,532	5.4	4.7
SCD, SHD	121B	111,215	7.6	7.0
SCD, SHD	161B	167,482	11.4	7.2
SCD, SHD	201B	197,727	13.5	6.1

① Heating capacities based on 70°F DB entering air , 180°F entering water, 30°F water temperature drop in SHD unit with plenum operating at high fan speed with no external static pressure. For heating coil capacity ratings at conditions other than those listed, refer to the MS-85 Computer Selection Program or consult your representative.

Table 6. Separate 1-row coil water heating and steam capacity ratings ①

UNIT TYPES	SIZE	HEATING CAPACITY (SENSIBLE BTUH)		WATER FLOW (GPM)	WATER P.D. (FT. W.C.)
		STEAM ②	HOT WATER ③		
SCD, SHD	061B	33,554	12,291	0.8	0.6
SCD, SHD	081B	46,343	19,470	1.3	2.1
SCD, SHD	121B	54,882	26,570	1.8	3.6
SCD, SHD	161B	68,353	37,101	2.5	0.7
SCD, SHD	201B	88,161	47,175	3.2	0.8

① For water heating coil capacity ratings at conditions other than those listed, refer to MS-85 Computer Selection Program or consult your representative. For steam heating coil capacity ratings other than those listed, use the conversion factors on page 10.
② Heating coil capacities based on 2 psig steam pressure and 60°F DB entering air temperature in SHD unit with plenum operating at high fan speed with no external static pressure.
③ Heating capacities based on 70°F DB entering air, 180°F entering water, 30°F water temperature drop in SHD unit with plenum operating at high fan speed with no external static pressure.

Table 7. Separate 2-row coil water heating and steam ratings ①

UNIT TYPES	SIZE	HEATING CAPACITY (SENSIBLE BTUH)		WATER FLOW (GPM)	WATER P.D. (FT. W.C.)
		STEAM ②	HOT WATER ③		
SCD, SHD	061B	52,309	17,905	1.2	0.3
SCD, SHD	081B	72,841	30,472	2.1	1.0
SCD, SHD	121B	87,975	46,327	3.2	2.6
SCD, SHD	161B	113,572	72,048	4.9	0.6
SCD, SHD	201B	144,386	85,713	5.8	0.6

① For water heating coil capacity ratings at conditions other than those listed, refer to MS-85 Computer Selection Program or consult your representative. For steam heating coil capacity ratings other than those listed, use the conversion factors on pege 10.
② Heating coil capacities based on 2 psig steam pressure and 60°F DB entering air temperature in SHD unit with plenum operating at high fan speed with no external static pressure.
③ Heating capacities based on 70°F DB entering air, 180°F entering water, 30°F water temperature drop in SHD unit with plenum operating at high fan speed with no external static pressure.

Water cooling coil ratings — belt drive units

Table 8. Standard coil water cooling capacity ratings ①

UNIT TYPES	SIZE	AIRFLOW (CFM)	COOLING CAPACITY ②		WATER FLOW (GPM)	WATER P.D. (FT. W.C.)
			TOTAL BTUH	SENSIBLE BTUH		
SCB, SHB	081B	800	24,000	17,700	4.8	3.1
		900	25,615	19,241	5.1	3.4
SCB, SHB	121B	1200	37,265	27,027	7.5	8.2
		1300	38,898	28,581	7.8	8.8
SCB, SHB	161B	1600	48,421	35,472	9.7	2.7
		1800	51,521	38,482	10.3	3.0
SCB, SHB	201B	2000	57,596	45,014	11.5	2.9
		2200	60,565	48,102	12.1	3.1
SCB, SHB	301B	3000	91,633	66,864	18.3	2.9
		3200	94,813	69,923	19.0	3.1

① Cooling capacities based on 80°F DB/67°F WB entering air, 45°F water, 10°F water temperature rise.
② For cooling coil capacity ratings at conditions other than those listed, refer to the MS-85 Computer Selection Program or consult your McQuay representative.

Table 9. High capacity coil water cooling capacity ratings ①

UNIT TYPES	SIZE	AIRFLOW (CFM)	COOLING CAPACITY ②		WATER FLOW (GPM)	WATER P.D. (FT. W.C.)
			TOTAL BTUH	SENSIBLE BTUH		
SCB, SHB	081B	800	30,019	21,726	6.0	7.4
		900	32,502	23,845	6.5	8.5
SCB, SHB	121B	1200	46,515	33,107	9.3	13.0
		1300	49,140	35,276	9.8	14.3
SCB, SHB	161B	1600	59,924	43,270	12.0	10.2
		1800	64,860	47,477	13.0	11.7
SCB, SHB	201B	2000	77,358	54,939	15.5	10.1
		2200	82,482	59,209	16.5	11.3
SCB, SHB	301B	3000	117,951	79,983	23.6	3.6
		3200	123,360	84,205	24.5	3.9

① Cooling capacities based on 80°F DB/67°F WB entering air, 45°F water, 10°F water temperature rise.
② For cooling coil capacity ratings at conditions other than those listed, refer to the MS-85 Computer Selection Program or consult your McQuay representative.

Direct expansion coil ratings — belt drive units

Table 10. Direct expansion coil cooling capacity ratings ①

UNIT TYPES	SIZE	AIRFLOW (CFM)	STD. DX COIL COOLING CAPACITY		HI-CAP. DX COIL COOLING CAPACITY	
			TOTAL BTUH	SENSIBLE BTUH	TOTAL BTUH	SENSIBLE BTUH
SCB, SHB	081B	800	21,200	15,100	28,196	19,177
		900	22,260	15,855	29,605	20,136
SCB, SHB	121B	1200	30,500	22,700	40,565	28,602
		1300	32,025	23,835	42,593	30,032
SCB, SHB	161B	1600	41,900	30,800	55,727	39,116
		1800	44,633	32,956	59,628	41,854
SCB, SHB	201B	2000	53,100	39,000	70,623	49,530
		2200	56,817	41,730	75,567	52,997
SCB, SHB	301B	3000	78,000	58,000	107,640	73,660
		3200	83,460	62,060	115,175	78,816

① Direct expansion coil ratings based on 80°F DB/67°F WB entering air and 45°F refrigerant suction temperature. DX coils include distributor but all other refrigerant accessories such as capillary tubes, expansion valves, sightglasses, solenoid valves, strainers, etc., must be furnished and mounted by others. For direct expansion cooling coil ratings at conditions other than those listed, refer to the direct expansion unit selection manual supplement to this catalog.

Steam heating coil conversion factors

STEAM PRESSURE	STEAM TEMP. (SAT.)	LATENT HEAT	ENTERING AIR TEMPERATURE									
			0	10	20	30	40	50	60	70	80	90
0	212.0	970.3	1.34	1.27	1.21	1.15	1.08	1.02	0.96	0.90	0.83	0.77
2	218.5	966.1	1.38	1.31	1.25	1.19	1.13	1.06	1.00	0.94	0.87	0.81
5	227.1	960.6	1.43	1.37	1.31	1.24	1.18	1.12	1.06	0.99	0.93	0.87
10	239.4	952.6	1.51	1.45	1.38	1.32	1.26	1.20	1.13	1.07	1.01	0.94
15	249.7	945.6	1.57	1.51	1.45	1.38	1.32	1.26	1.20	1.13	1.07	1.01
20	258.8	939.6	1.63	1.57	1.51	1.44	1.38	1.32	1.25	1.19	1.13	1.06
25	266.8	934.0	1.68	1.62	1.56	1.50	1.43	1.37	1.31	1.24	1.17	1.12

To determine the capacity at conditions other than 2 PSIG steam and 60°F entering air, multiply the rated capacity by the proper conversion factor.

Water heating & steam coil ratings — belt drive units

Table 11. Standard coil water water heating capacity ratings ①

UNIT TYPES	SIZE	AIRFLOW (CFM)	HEATING CAPAC. ② (SENSIBLE BTUH)	WATER FLOW (GPM)	WATER P.D. (FT. W.C.)
SCB, SHB	081B	800	56,160	3.8	1.6
		900	60,487	4.1	1.8
SCB, SHB	121B	1200	86,725	5.9	4.2
		1300	91,262	6.2	4.6
SCB, SHB	161B	1600	113,798	7.8	1.4
		1800	122,497	8.3	1.6
SCB, SHB	201B	2000	138,515	9.4	1.6
		2200	147,021	10.0	1.7
SCB, SHB	301B	3000	224,740	15.3	1.7
		3200	234,140	16.0	1.8

① Heating capacities based on 70°F DB entering air, 180°F entering water, 30°F water temperature drop.
② For heating coil capacity ratings at conditions other than those listed, refer to the MS-85 Computer Selection Program or consult your representative.

Table 12. High capacity coil water water heating capacity ratings ①

UNIT TYPES	SIZE	AIRFLOW (CFM)	HEATING CAPAC. ② (SENSIBLE BTUH)	WATER FLOW (GPM)	WATER P.D. (FT. W.C.)
SCB, SHB	081B	800	71,080	4.8	3.9
		900	78,229	5.3	4.6
SCB, SHB	121B	1200	115,118	7.8	7.4
		1300	123,012	8.4	8.3
SCB, SHB	161B	1600	148,216	10.1	5.8
		1800	163,138	11.1	6.9
SCB, SHB	201B	2000	185,494	12.6	5.4
		2200	200,542	13.7	6.3
SCB, SHB	301B	3000	275,803	18.8	1.9
		3200	290,980	19.8	2.0

① Heating capacities based on 70°F DB entering air, 180°F entering water, 30°F water temperature drop.
② For heating coil capacity ratings at conditions other than those listed, refer to the MS-85 Computer Selection Program or consult your representative.

Table 13. Separate 1-row coil water heating and steam capacity ratings ①

UNIT TYPES	SIZE	AIRFLOW (CFM)	HEATING CAPACITY (SENSIBLE BTUH)		WATER FLOW (GPM)	WATER P.D. (FT. W.C.)
			STEAM ②	HOT WATER ③		
SCB, SHB	081B	800	44,625	18,741	1.3	1.9
		900	47,290	19,723	1.3	2.1
SCB, SHB	121B	1200	56,878	27,474	1.9	3.8
		1300	58,883	28,482	1.9	4.0
SCB, SHB	161B	1600	65,590	35,156	2.4	0.6
		1800	68,635	37,110	2.5	0.7
SCB, SHB	201B	2000	87,077	46,313	3.2	0.8
		2200	90,486	83,867	5.7	2.9
SCB, SHB	301B	3000	103,113	83,867	5.7	2.9
		3200	105,462	86,528	5.9	3.0

① For water heating coil capacity ratings at conditions other than those listed, refer to MS-85 Computer Selection Program or consult your representative. For steam heating coil capacity ratings other than those listed, use the conversion factors on page 10.
② Heating coil capacities based on 2 psig steam pressure and 60°F DB entering air temperature.
③ Heating capacities based on 70°F DB entering air, 180°F entering water, and 30°F water temperature drop.

Table 14. Separate 2-row coil water heating and steam capacity ratings ①

UNIT TYPES	SIZE	AIRFLOW (CFM)	HEATING CAPACITY (SENSIBLE BTUH)		WATER FLOW (GPM)	WATER P.D. (FT. W.C.)
			STEAM ②	HOT WATER ③		
SCB, SHB	081B	800	72,807	30,155	2.1	1.0
		900	77,933	32,030	2.2	1.1
SCB, SHB	121B	1200	95,097	49,769	3.4	3.0
		1300	99,071	51,949	3.5	3.2
SCB, SHB	161B	1600	111,671	69,869	4.8	0.6
		1800	117,834	74,564	5.1	0.7
SCB, SHB	201B	2000	147,770	87,147	5.9	0.6
		2200	154,673	91,871	6.3	0.7
SCB, SHB	301B	3000	179,728	155,638	10.6	1.5
		3200	184,583	161,498	11.0	1.6

① For water heating coil capacity ratings at conditions other than those listed, refer to MS-85 Computer Selection Program or consult your representative. For steam heating coil capacity ratings other than those listed, use the conversion factors on page 10.
② Heating coil capacities based on 2 psig steam pressure and 60°F DB entering air temperature.
③ Heating capacities based on 70°F DB entering air, 180°F entering water, and 30°F water temperature drop.

Airflow capacity data
SCD & SHD direct drive units

Table 15. Air volume vs. external static pressure — SHD hideaway unit (cfm)

EXTERNAL STATIC PRESS. (IN. H_2O)		UNIT SIZE				
		061B	081B	121B	161B	201B
0.00	HIGH	838	990	1410	2013	2563
	MED	657	810	1170	1811	2300
	LOW	362	479	688	1049	1409
0.10	HIGH	814	963	1339	1944	2435
	MED	627	797	1124	1782	2198
	LOW	343	479	662	1042	1364
0.20	HIGH	759	925	1261	1856	2290
	MED	593	775	1062	1719	2081
	LOW	312	471	627	1019	1298
0.30	HIGH	700	882	1175	1761	2129
	MED	554	750	992	1645	1943
	LOW	274	457	584	979	1215
0.40	HIGH	633	832	1081	1653	1943
	MED	507	717	910	1553	1774
	LOW	231	436	530	914	1113
0.50	HIGH	553	769	974	1509	1708
	MED	440	668	802	1406	1560
	LOW	183	402	465	814	992
0.60	HIGH	443	679	846	1285	1390
	MED	340	590	643	1137	1284
	LOW	128	347	387	664	850

NOTE: Air volumes based on 115/60/1 electrical service, standard water cooling coil (dry coil) and normal unit appurtenances. "High" indicates highest fan speed. "Med" indicates air volume for medium high (second of four fan speeds). "Low" indicates lowest fan speed.

Table 16. Air volume vs. external static pressure — SCD cabinet unit and SHD hideaway with plenum (cfm)

EXTERNAL STATIC PRESS. (IN. H_2O)		UNIT SIZE				
		061B	081B	121B	161B	201B
0.00	HIGH	740	930	1185	1910	2232
	MED	640	825	1068	1747	1996
	LOW	365	505	687	1050	1233
0.10	HIGH	697	886	1119	1834	2113
	MED	599	793	1010	1700	1887
	LOW	344	500	651	1040	1176
0.20	HIGH	643	832	1044	1743	1974
	MED	550	751	941	1634	1759
	LOW	312	485	602	1025	1091
0.30	HIGH	582	770	962	1641	1814
	MED	496	702	865	1548	1614
	LOW	274	464	543	989	992
0.40	HIGH	516	702	873	1524	1634
	MED	435	645	786	1437	1453
	LOW	230	433	476	920	885
0.50	HIGH	435	624	776	1379	1429
	MED	361	576	699	1295	1274
	LOW	179	382	399	810	766
0.60	HIGH	325	530	670	1186	1193
	MED	265	485	601	1108	1072
	LOW	119	295	306	655	631

NOTE: Air volumes based on 115/60/1 electrical service, standard water cooling coil (dry coil) and normal unit appurtenances. "High" indicates highest fan speed. "Med" indicates air volume for medium high (second of four fan speeds). "Low" indicates lowest fan speed.

Airflow capacity data
SCB & SHB belt drive units

Table 17. Component static resistance

SCB/SHB MODEL	CFM	STATIC PRESSURE (INCHES OF WATER)								
		SHB PLENUM OR SCB CABINET	COOLING COIL (WET)		HEATING COIL		GRILLES		FILTERS	
			STD.	HIGH CAPACITY	1 ROW	2 ROW	STAMPED	DOUBLE DEFLEC.	THROW-AWAY	CLEAN-ABLE
081B	500	.06	.18	.25	.05	.10	.03	.02	.09	.08
	600	.09	.24	.33	.07	.13	.04	.03	.11	.10
	700	.12	.31	.42	.09	.17	.05	.04	.13	.13
	800	.16	.38	.51	.11	.22	.06	.06	.15	.16
	900	.20	.46	.61	.13	.26	.07	.07	.17	.20
121B	800	.09	.21	.30	.06	.12	.03	.02	.11	.11
	900	.11	.26	.36	.07	.14	.04	.02	.13	.14
	1000	.14	.31	.42	.09	.17	.04	.03	.15	.16
	1100	.16	.35	.48	.10	.20	.05	.03	.17	.19
	1200	.19	.41	.55	.12	.23	.06	.04	.19	.22
	1300	.23	.46	.62	.13	.27	.06	.05	.22	.26
161B	1200	.10	.25	.35	.07	.14	.05	.03	.11	.10
	1300	.12	.29	.39	.08	.16	.05	.04	.12	.12
	1400	.14	.32	.44	.09	.18	.06	.04	.13	.13
	1500	.16	.36	.49	.10	.21	.07	.05	.14	.15
	1600	.19	.40	.54	.11	.23	.07	.06	.15	.16
	1700	.21	.44	.59	.13	.25	.08	.06	.16	.18
	1800	.24	.48	.64	.14	.28	.09	.07	.17	.20
201B	1600	.17	.29	.39	.08	.16	.06	.06	.11	.11
	1700	.20	.32	.43	.09	.18	.07	.06	.12	.13
	1800	.22	.34	.46	.10	.19	.07	.07	.13	.14
	1900	.24	.38	.50	.11	.21	.08	.08	.14	.15
	2000	.27	.41	.54	.12	.23	.09	.08	.15	.16
	2100	.30	.44	.59	.13	.25	.09	.09	.16	.18
	2200	.33	.47	.63	.14	.27	.10	.11	.17	.19
301B	2000	.06	.22	.30	.06	.12	.04	.03	.11	.11
	2200	.07	.25	.35	.07	.14	.05	.03	.13	.13
	2400	.09	.29	.40	.08	.16	.06	.04	.14	.15
	2600	.10	.33	.45	.09	.19	.06	.05	.16	.17
	2800	.12	.37	.50	.11	.21	.07	.06	.17	.20
	3000	.14	.41	.56	.12	.24	.08	.07	.19	.22
	3200	.15	.46	.61	.13	.26	.09	.07	.21	.25

Table 18. Fan performance

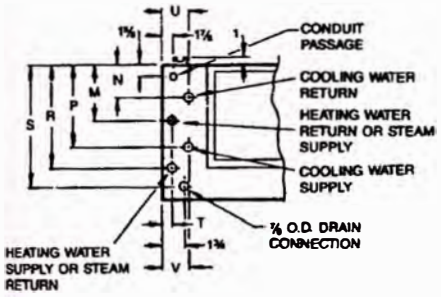
SCB/SHB MODEL	CFM	COIL FACE VELOC. FPM	TOTAL STATIC PRESSURE (INCHES OF WATER)															
			¼"		⅜"		½"		⅝"		¾"		1"		1¼"		1½"	
			RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
081B	500	300	558	.080	691	.097	798	.109	888	.130	970	.165	1125	.200	1257	.243	1381	.225
	600	360	563	.090	683	.110	790	.130	879	.150	959	.190	1118	.215	1250	.260	1381	.250
	700	420	581	.100	690	.135	792	.145	877	.170	950	.205	1107	.262	1238	.290	1369	.310
	800	480	599	.110	698	.160	793	.160	876	.190	946	.220	1097	.310	1226	.320	1358	.370
	900	540	621	.125	715	.165	803	.175	881	.205	950	.240	1095	.375	1220	.385	1347	.410
121B	800	335	589	.119	696	.145	787	.164	875	.192	972	.227	1127	.285	1268	.340	1400	.415
	900	375	606	.136	707	.162	795	.189	881	.212	968	.247	1118	.309	1257	.371	1387	.445
	1000	415	623	.153	717	.178	803	.204	887	.231	964	.266	1104	.333	1245	.402	1373	.475
	1100	460	643	.170	733	.200	816	.228	898	.261	972	.296	1110	.364	1239	.432	1363	.504
	1200	500	663	.188	748	.222	828	.251	909	.290	980	.325	1111	.394	1233	.462	1352	.532
	1300	540	686	.219	767	.251	834	.287	922	.326	992	.361	1117	.409	1236	.504	1351	.577
161B	1200	370	563	.180	683	.220	790	.260	879	.300	959	.380	1118	.430	1250	.520	1381	.500
	1300	400	572	.190	686	.246	791	.278	878	.320	952	.394	1113	.478	1244	.550	1375	.560
	1400	435	581	.200	690	.270	792	.290	877	.340	950	.410	1107	.524	1238	.580	1369	.620
	1500	465	590	.210	694	.296	792	.306	876	.360	948	.424	1102	.572	1232	.610	1364	.680
	1600	495	599	.220	698	.320	793	.320	876	.380	946	.440	1097	.620	1226	.640	1358	.740
	1700	525	610	.236	706	.326	798	.336	878	.396	948	.460	1096	.686	1223	.706	1352	.780
	1800	560	621	.250	715	.330	803	.350	881	.410	950	.480	1095	.750	1220	.770	1347	.820
201B	1600	400	589	.238	696	.290	787	.328	875	.384	972	.454	1127	.570	1268	.680	1400	.830
	1700	425	598	.258	701	.306	791	.354	878	.404	970	.474	1122	.594	1263	.712	1393	.860
	1800	450	606	.272	707	.324	795	.378	881	.424	968	.494	1118	.618	1257	.742	1387	.890
	1900	475	615	.290	712	.340	799	.384	884	.442	966	.512	1114	.642	1251	.774	1380	.920
	2000	500	623	.306	717	.356	803	.408	887	.462	964	.532	1104	.666	1245	.804	1373	.950
	2100	525	633	.324	725	.378	810	.432	893	.492	968	.562	1110	.698	1242	.832	1368	.980
	2200	550	643	.340	733	.400	816	.456	898	.522	972	.592	1110	.728	1239	.864	1363	1.008
301B	2000	335	507	.310	600	.360	693	.420	773	.520	843	.600	977	.760	1102	.940	1217	1.014
	2200	370	518	.330	609	.400	699	.470	771	.550	842	.630	972	.800	1094	.960	1205	1.018
	2400	405	529	.360	618	.440	705	.520	770	.580	841	.660	967	.840	1086	.980	1194	1.220
	2600	435	543	.400	629	.480	711	.550	776	.620	844	.710	967	.880	1082	1.036	1188	1.280
	2800	470	558	.440	640	.520	718	.580	782	.660	847	.760	968	.920	1078	1.090	1182	1.350
	3000	505	574	.470	655	.560	728	.626	791	.710	855	.810	977	.990	1080	1.156	1179	1.390
	3200	540	591	.500	671	.600	739	.670	800	.760	863	.860	987	1.060	1082	1.220	1176	1.420

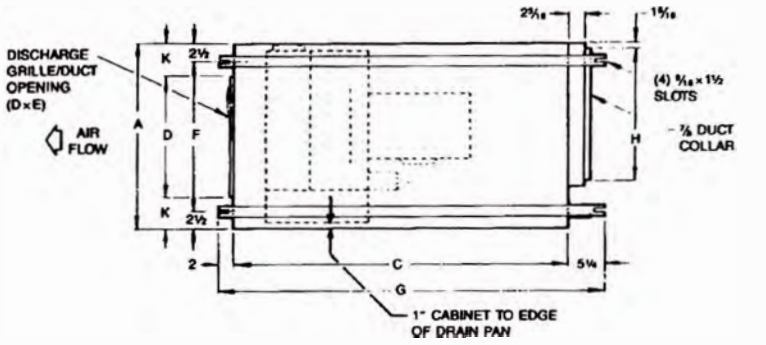
NOTE: Maximum allowable NEMA motor frame for SCB/SHB-081 and 121B is size 56; for SCB/SHB-161 thru 301B maximum frame size is 145.

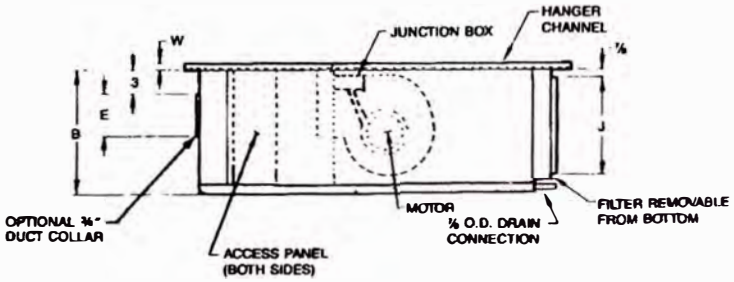
Direct drive dimensional data

SCD CABINET TYPE

RIGHT HAND UNIT SHOWN
HAND DETERMINED BY COOLING COIL CONNECTION WHEN FACING DISCHARGE.







KNOCKOUT DIMENSIONS (INCHES)			
UNIT	ELEC.	CLG S&R	HTG S&R
061, 081	1 3/32	1¼	1½
121	1 3/32	1⅜	1½
161	1 3/32	1⅜	1½
201	1 3/32	1⅜	1¾

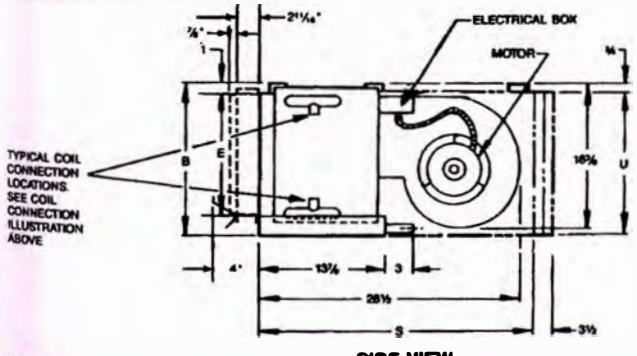
NOTE: Coil connection knockouts are not necessarily in line with the coil connections.

SCD MODEL	DIMENSIONS (INCHES)																		
	A	B	C	D	E	F	G	H	J	K	M	N	P	R	S	T	U	V	W
061B	24	17⅝	37	20	4	19	44¼	18½	14⅝	2	4 7/16	2 11/16	9 9/16	11⅜	14¼	1 9/16	1 9/16	1 9/16	1
081B	26	17⅝	46	20	6	21	53¼	18½	14⅝	3	4 7/16	4 7/16	12 1/16	13⅞	16¾	1 9/16	3¾	3¾	1
121B	33	17⅝	46	24	8	28	53¼	23½	14⅝	4½	4 7/16	4 7/16	12 1/16	13⅞	16¾	1 9/16	3¾	3¾	1
161B	44	17⅝	46	36	6	39	53¼	38½	14⅝	4	4 7/16	2 11/16	8 3/16	13¾	16¾	2¼	2¼	2¼	1
201B	46	21⅛	50	41¾	6	41	57¼	38½	18⅝	2⅛	5 1/16	4⅛	9 7/16	16¼	19¼	2¼	4 3/16	4 3/16	1¼

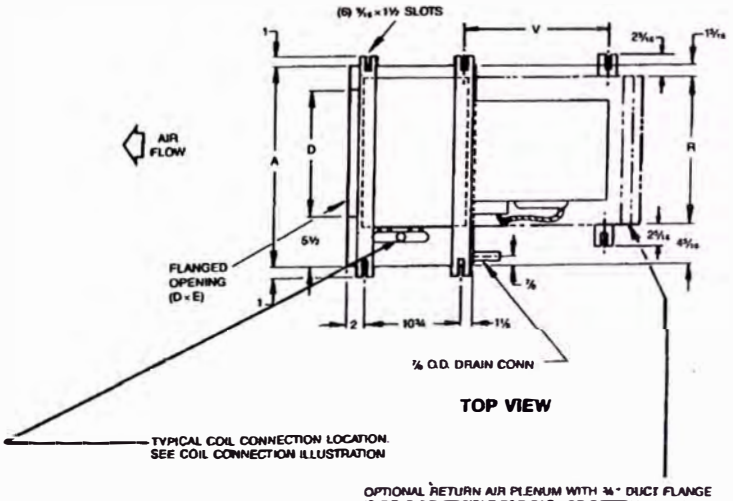
SHD HIDEAWAY TYPE

RIGHT HAND UNIT SHOWN
HAND DETERMINED BY COOLING COIL CONNECTIONS WHEN FACING DISCHARGE.

NOTE: Unit sizes 161B and 201B have two fans.



SIDE VIEW



TOP VIEW

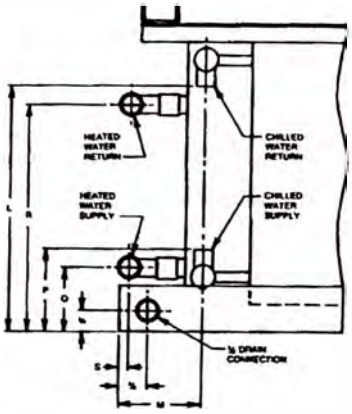
OPTIONAL RETURN AIR PLENUM WITH ¾" DUCT FLANGE IS FIELD REVERSIBLE FOR BACK OR BOTTOM INTAKE. ADD 3½" TO "U" DIMENSION FOR BOTTOM INTAKE

"DIMENSIONS APPLY TO 1- AND 2-ROW HEATING COILS. HEATING COIL CONNECTIONS HAVE THE SAME HAND AS THE COOLING COIL CONNECTIONS.

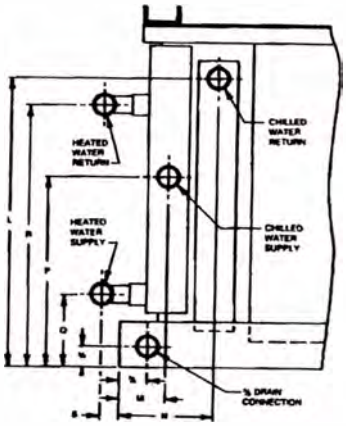
SHD MODEL	DIMENSIONS (INCHES)							
	A	B	D	E	R	S	U	V
061B	22	14	14	10⅞	16⅜	29⅝	15¾	15⅜
081B	24	16½	16	13⅜	18⅜	29⅝	15¾	15⅜
121B	31	16½	23	13⅜	25⅜	29⅝	15¾	15⅜
161B	39	16½	31	13⅜	33⅜	29⅝	15¾	15⅜
201B	41	19	33	15⅝	35⅜	32⅛	18¼	17⅜

ALL DIMENSIONS APPROXIMATE. CERTIFIED DRAWINGS AVAILABLE ON REQUEST.

TYPE SHD COIL CONNECTION LOCATIONS FOR CHILLED WATER COILS ONLY



REAR VIEW
UNIT SIZES 061B, 081B, 121B



REAR VIEW
UNIT SIZES 161B & 201B

UNIT SIZE	DIMENSIONS (INCHES)						
	L	M	N	P	Q ± 1/8	R ± 1/8	S ± 1/8
061B	10 7/8	2 3/4	—	4	2 7/8	9 13/16	11/16
081B	13 3/8	2 3/4	—	4	2 7/8	12 5/16	11/16
121B	13 3/8	2 3/4	—	4	2 7/8	12 5/16	1/4
161B	14	1 3/4	3 1/4	8	3 1/16	12 3/8	2
201B	15 1/4	1 3/4*	3 1/4	8	3 1/8	14 5/16	1 5/8

*1¼ for high capacity.

ALL DIMENSIONS APPROXIMATE. CERTIFIED DRAWINGS AVAILABLE ON REQUEST.

Direct drive physical data

Table 19. Direct drive unit physical data

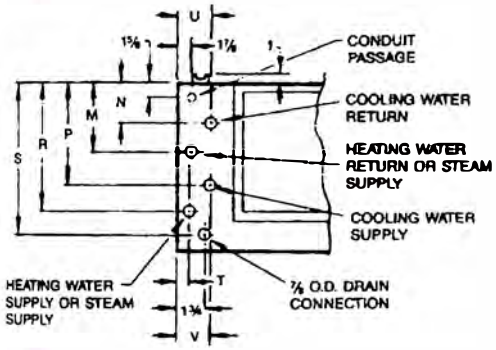
DATA		UNIT SIZE				
		061B	081B	121B	161B	201B
NOMINAL CFM		600	800	1200	1600	2000
FAN(S)						
TYPE		FORWARDLY CURVED — DWDI — DIRECT DRIVE				
NUMBER		1	1	1	2	2
DIAMETER (INCHES)		9	9	9	9	9
COIL(S)						
TYPE		COPPER TUBES (½" O.D.) WITH ALUMINUM FINS				
WATER CONN'S.	1 Row Coil (OD Sw)	3/4	3/4	1	1	1 1/4
	2 Row Coil (OD Sw)	3/4	1	1	1 1/4	1 1/4
	Std. Coil (OD Sw)	5/8	7/8	1 1/8	1 1/8	1 1/8
	Hi Cap Coil (OD Sw)	5/8	7/8	1 1/8	1 1/8	1 5/8
DX CONN'S. STD. CAPAC.	Liquid (OD Sw)	5/8	5/8	5/8	5/8	7/8
	Suction (OD Sw)	1 1/8	1 1/8	1 1/8	1 3/8	1 5/8
DX CONN'S. HI CAPAC.	Liquid (OD Sw)	5/8	5/8	5/8	5/8	7/8
	Suction (OD Sw)	1 1/8	1 1/8	1 3/8	1 3/8	1 5/8
MOTOR(S)						
TYPE		115/60/1 PERMANENT SPLIT CAPACITOR — DIRECT DRIVE				
(NUMBER) HORSEPOWER		(1) 1/4	(1) 1/4	(1) 1/3	(2) 1/4	(2) 1/3
AMPS (TOTAL)		3.5	3.9	4.9	7.8	9.8
WATTS (TOTAL)		310	380	480	686	960
RPM		1010	1000	1080	1000	1100
TYPE		277/60/1 PERMANENT SPLIT CAPACITOR — DIRECT DRIVE				
(NUMBER) HORSEPOWER		(1) 1/4	(1) 1/4	(1) 1/3	(2) 1/4	(2) 1/3
AMPS (TOTAL)		1.3	1.4	2.0	2.8	4.0
WATTS (TOTAL)		322	350	425	700	850
RPM		1020	1000	1100	1000	1100
TYPE		230/50/1 PERMANENT SPLIT CAPACITOR — DIRECT DRIVE				
(NUMBER) HORSEPOWER		(1) 1/4	(1) 1/4	(1) 1/3	(2) 1/4	(2) 1/3
AMPS (TOTAL)		2.4	2.5	2.2	5.0	4.4
WATTS (TOTAL)		510	550	500	1100	1000
RPM		1080	1020	1120	1080	1120
FILTER(S)						
SCD	NUMBER	1	1	1	2	2
	NOMINAL SIZE	16 x 20 x 2	16 x 20 x 2	16 x 25 x 2	16 x 20 x 2	20 x 20 x 2
SHD	NUMBER	1	1	1	1	1
	NOMINAL SIZE	15½ x 16⅛ x 2	15½ x 18 x 2	15½ x 25 x 2	15½ x 33 x 2	18 x 35⅛ x 2
SHIPPING WEIGHTS (LBS.)						
SCD WITH STANDARD COIL		158	191	228	297	387
SCD WITH HI-CAPACITY COIL		167	203	245	318	512
SHD WITH STANDARD COIL		92	98	115	160	180
SHD WITH HI-CAPACITY COIL		105	110	132	181	208

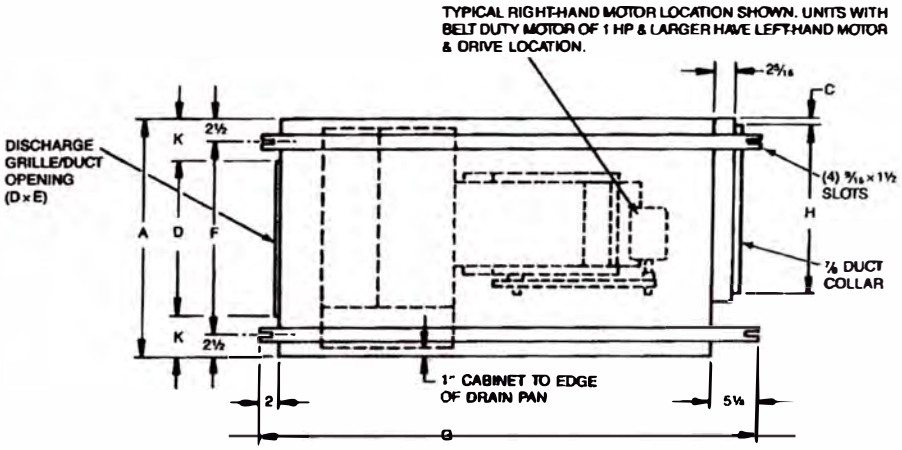
Belt drive dimensional data

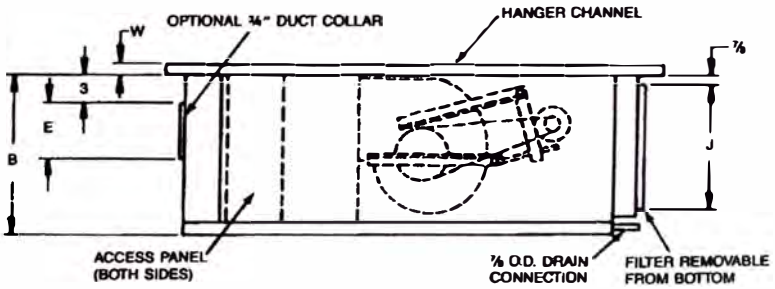
SCB CABINET TYPE

RIGHT HAND UNIT SHOWN

HAND DETERMINED BY COOLING COIL CONNECTION WHEN FACING DISCHARGE.







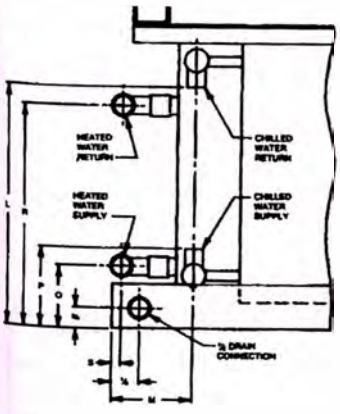
KNOCKOUT DIMENSIONS (INCHES)			
UNIT	ELEC.	CLG S&R	HTG S&R
081	1 3/32	1¼	1½
121	1 3/32	1⅜	1½
161	1 3/32	1⅜	1½
201	1 3/32	1⅜	1¾
301	1 3/32	1¾	1¾

NOTE: Coil connection knockouts are not necessarily in line with the coil connections.

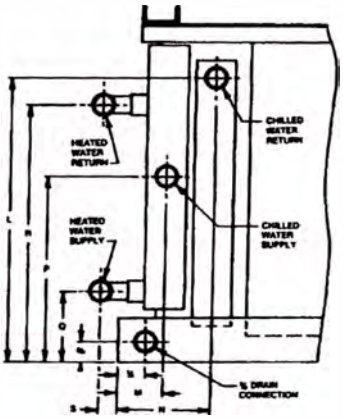
NOTE: UNIT SIZES 161B, 201B & 301B HAVE TWO FANS.

SCB MODEL	DIMENSIONS (INCHES)																		
	A	B	C	D	E	F	G	H	J	K	M	N	P	R	S	T	U	V	W
081B	26	17⅝	1¼	20	6	21	53¼	18½	14⅝	3	4 7/16	4 7/16	12 1/16	13⅞	16¾	1 9/16	3¾	3¾	1
121B	33	17⅝	1¼	24	8	28	53¼	23½	14⅝	4½	4 7/16	4 7/16	12 1/16	13⅞	16¾	1 9/16	3¾	3¾	1
161B	44	17⅝	1¼	36	6	39	53¼	38½	14⅝	5	4 7/16	2 11/16	8 3/16	13¾	16¾	2¼	2¼	2¼	1
201B	46	21⅛	1¼	41¾	6	41	57¼	38½	18⅝	2⅛	5 1/16	4⅛	9 7/16	16¼	19¼	2¼	4 3/16	4 3/16	1¼
301B	62	21⅛	6¾	49¾	8	57	57¼	48½	18⅝	6⅛	5 1/16	2⅞	9 7/16	16¼	19¼	2¼	4	4	1¼

TYPE SHB COIL CONNECTION LOCATIONS



REAR VIEW
UNIT SIZES 081B & 121B



· REAR VIEW
UNIT SIZES 161B THRU 301B

UNIT SIZE	DIMENSIONS (INCHES)						
	L	M	N	P	Q ± 1/16	R ± 1/16	S ± 1/16
081B	13⅜	2¾	—	4	2⅞	12 5/16	1 1/16
121B	13⅜	2¾	—	4	2⅞	12 5/16	¼
161B	14	1¾	3⅜	8	3 1/16	12⅜	2
201B	15¼	1¾*	3⅜	8	3 1/16	14 5/16	1⅝
301B	16½	4	6¼	8	3 1/16	14 5/16	2½**

**This dimenson is inside the edge of the drain pan as shown in 081, 121 diagram.

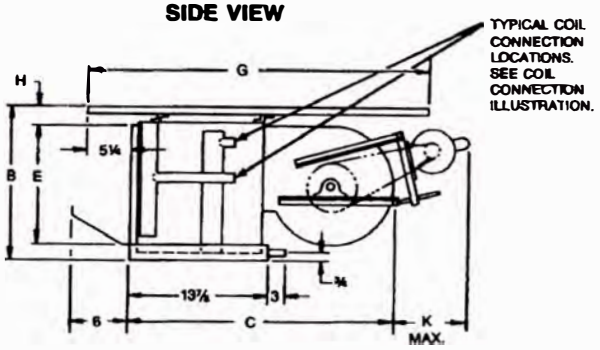
*1¼ for high capacity coil.

ALL DIMENSIONS APPROXIMATE. CERTIFIED DRAWINGS AVAILABLE ON REQUEST.

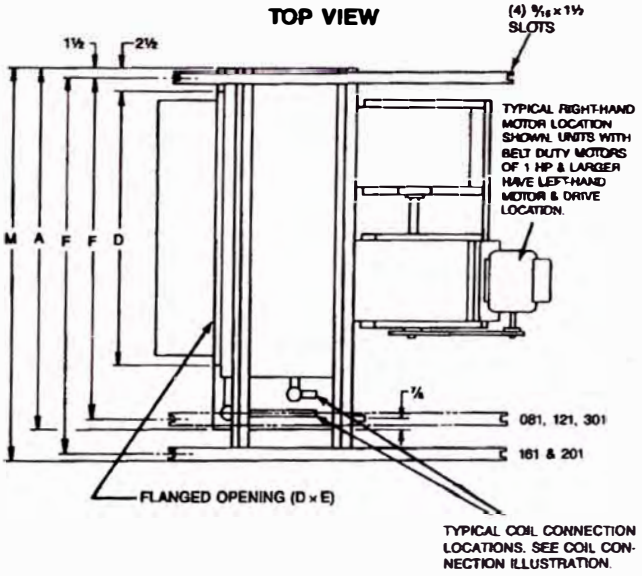
SHB HIDEAWAY TYPE WITH HANGING RAILS

RIGHT HAND UNIT SHOWN
HAND DETERMINED BY COOLING COIL CONNECTION WHEN FACING DISCHARGE.

SIDE VIEW



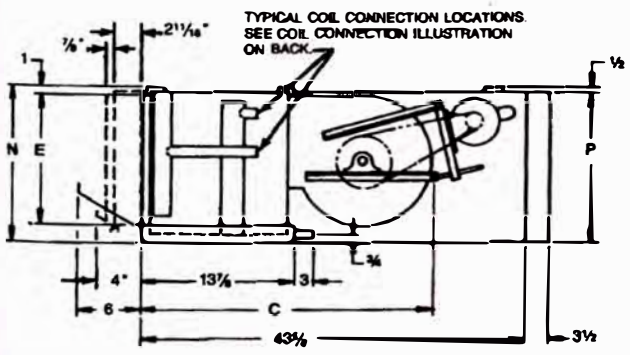
TOP VIEW



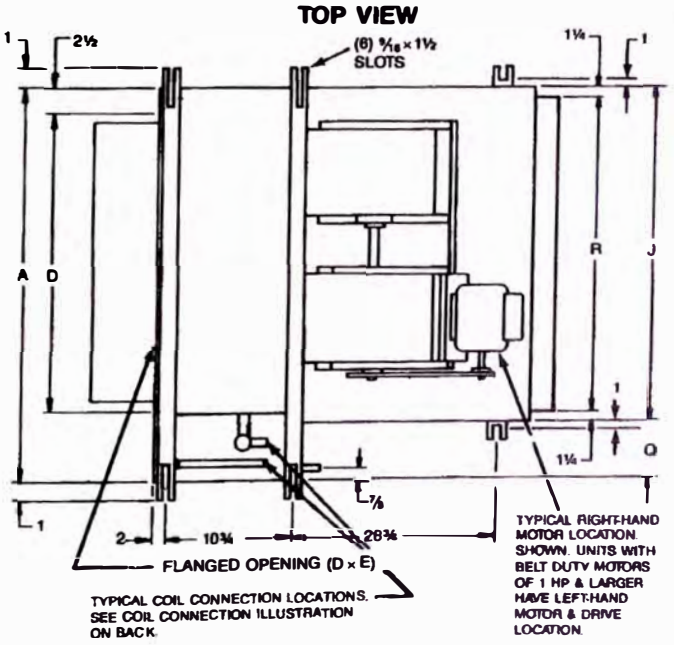
SHB HIDEAWAY TYPE WITH OPTIONAL RETURN AIR PLENUM

RIGHT HAND UNIT SHOWN
HAND DETERMINED BY COOLING COIL CONNECTION WHEN FACING DISCHARGE.

SIDE VIEW



TOP VIEW



*DIMENSIONS APPLY TO 1- ~~AND 2 ROW HEATING COILS.~~ HEATING COIL CONNECTIONS HAVE THE SAME HAND AS THE COOLING COIL CONNECTIONS.

NOTES:
1. UNIT MUST BE SUPPORTED AT ALL SIX HANGING SLOTS.
2. RETURN AIR PLENUM WITH ¾" DUCT FLANGE IS FIELD REVERSIBLE FOR BACK OR BOTTOM INTAKE. ADD 3½" TO "P" DIMENSION FOR BOTTOM INTAKE.

SHB MODEL	NO. OF FANS	DIMENSIONS (INCHES)								
		A	C	D	E	J	N	P	Q	R
081B	1	24	28½	16¼	13⅜	21	16½	15¾	3	18½
121B	1	31	28½	23	13⅜	28	16½	15¾	3	25½
161B	2	39	28½	31	13⅜	36	16½	15¾	3	33½
201B	2	41	28½	33¼	15⅝	38	18¾	18¼	3	35½
301B	2	60	30	49	15⅝	54	18¾	18¼	6	51½

ALL DIMENSIONS APPROXIMATE. CERTIFIED DRAWINGS AVAILABLE ON REQUEST.

Belt drive physical data

Table 20. Belt drive unit physical data

DATA		UNIT SIZE				
		061B	121B	161B	201B	301B
NOMINAL CFM		800	1200	1600	2000	3000
FAN(S)						
TYPE		FORWARDLY CURVED — DWDI — BELT DRIVE				
NUMBER		1	1	2	2	2
DIAMETER (INCHES)		9	9	9	9	10
COIL(S)						
TYPE		COPPER TUBES (½" O.D.) WITH ALUMINUM FINS				
WATER CONN'S.	1 Row Coil (OD Sw)	¾	1	1	1¼	1¼
	2 Row Coil (OD Sw)	1	1	1¼	1¼	1¼
	Std. Coil (OD Sw)	⅞	1⅛	1⅛	1⅛	1⅝
	HI Cap Coil (OD Sw)	⅞	1⅛	1⅛	1⅝	1⅝
DX CONN'S. STD. CAPAC.	Liquid (OD Sw)	⅝	⅝	⅝	⅞	⅞
	Suction (OD Sw)	1⅛	1⅛	1⅜	1⅝	1⅝
DX CONN'S. HIGH CAPAC.	Liquid (OD Sw)	⅝	⅝	⅝	⅞	⅞
	Suction (OD Sw)	1⅛	1⅜	1⅜	1⅝	1⅝
FILTER(S)						
SCB	NUMBER	1	1	2	2	2
	NOMINAL SIZE	16 x 20 x 2	16 x 25 x 2	16 x 20 x 2	20 x 20 x 2	20 x 25 x 2
SHB	NUMBER	1	1	1	1	2
	NOMINAL SIZE	15½ x 18 x 2	15½ x 25 x 2	15½ x 33 x 2	18 x 35⅛ x 2	18 x 25½ x 2
SHIPPING WEIGHTS (LBS.)						
SCB WITH STANDARD COIL		206	233	315	407	512
SCB WITH HI-CAPACITY COIL		218	250	336	435	551
SHB WITH STANDARD COIL		113	130	178	200	230
SHB WITH HI-CAPACITY COIL		125	147	199	228	268

Engineering guide specifications — Direct drive

GENERAL — Furnish and install where shown on the plans, McQuay (hideaway type, direct drive) (cabinet type, direct drive) fan-coil units. Types, sizes and performance shall be as tabulated in the unit schedule. Unit performance shall be substantiated by computer generated output data. Each unit type shall consist of and comply with the following:

CABINET (CABINET TYPE) — Cabinet shall be a horizontal console type fabricated of continuous galvanized steel and finished with an electrostatically applied, baked-on Mist Gray paint. All panels shall be insulated with 1″ neoprene coated glass fiber. Discharge panel shall be equipped with (stamped grille) (double deflection grille) (duct collar). Back panel shall have a 2″ filter frame with bottom filter access and be complete with duct collar. Filter shall be 2″ throwaway type. Bottom and side panels shall be removable for inspection and maintenance.

CABINET (HIDEAWAY TYPE) — Cabinet shall consist of a base casing (only) (with return air plenum) fabricated of continuous galvanized steel. Return air plenum shall be insulated with 1″ neoprene coated glass fiber and have a filter frame for back or bottom return air. Filter shall be 2″ (throwaway) (cleanable) type.

FANS AND MOTORS — Fans shall be double width, double inlet, forward curved centrifugal type, dynamically balanced and directly connected to the motor shaft. Motors shall be (115/60/1) (277/60/1) (230/50/1) permanent split capacitor type with resilient mount, sleeve bearings with oilers and inherent thermal overload protection with automatic reset.

COIL — Coil shall be of the extended surface fin and staggered tube type constructed of ½″ O.D. seamless copper tubing and aluminum fins. All coils shall have manual air vents. Coil capacity shall be as tabulated in the unit schedule.

DRAIN PAN — Drain pan shall be fabricated of continuous galvanized steel, insulated with closed cell insulation and sealed with mastic.

SPEED CONTROL — Unit shall be equipped with four-speed direct drive motors. A three-speed motor control switch with "off" position shall be furnished for field wiring to any three of the four motor speeds. The speed switch shall be suitable for field installation in a nominal 2″ × 4″ electrical box by others.

Engineering guide specifications — Belt drive

GENERAL — Furnish and install where shown on the plans, McQuay large capacity (hideaway type, belt drive) (cabinet type, belt drive) fan-coil units. Types, sizes and performance shall be as tabulated in the unit schedule. Unit performance shall be substantiated by computer generated output data. Each unit type shall consist of and comply with the following:

CABINET (CABINET TYPE) — Cabinet shall be a horizontal console type fabricated of continuous galvanized steel and finished with an electrostatically applied, baked-on Mist Gray paint. All panels shall be insulated with 1″ neoprene coated glass fiber. Discharge panel shall be equipped with (stamped grille) (double deflection grille) (duct collar). Back panel shall have a 2″ filter frame with bottom filter access and be complete with duct collar. Filter shall be 2″ throwaway type. Bottom and side panels shall be removable for inspection and maintenance.

CABINET (HIDEAWAY TYPE) — Cabinet shall consist of a base casing (only) (with return air plenum) fabricated of continuous galvanized steel. Return air plenum shall be insulated with 1″ neoprene coated glass fiber and have a filter frame for back or bottom return air. Filter shall be 2″ (throwaway) (cleanable) type.

FANS — Fans shall be double width, double inlet, forward curved centrifugal type, dynamically balanced and mounted on solid-steel shaft. Fan bearings shall be permanently lubricated, resiliently mounted, self-aligning ball bearings.

COIL — Coil shall be of the extended surface fin and staggered tube type constructed of ½″ O.D. seamless copper tubing and aluminum fins. All coils shall have manual vents. Coil capacity shall be as tabulated in the unit schedule.

DRAIN PAN — Drain pan shall be fabricated of continuous galvanized steel, insulated with closed cell insulation and sealed with mastic.

MOTOR AND DRIVE — Motor mount shall be a hinged type for simple belt tension adjustment and be securely fastened to unit. Drive shall be V-belt with a variable pitch motor sheave. Motor shall be drip-proof type with a minimum horsepower and electrical service as tabulated in the unit schedule.

Total system capability.

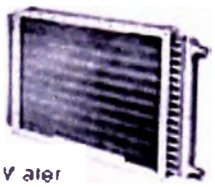
Thinline
Fan-coils

Hi Line
Fan coil

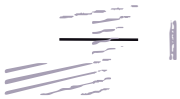
UltraSeal
Low Leak Dampers

SeasonMaster
Centr l Station Air Handler

Evaporator



V ater
Heating



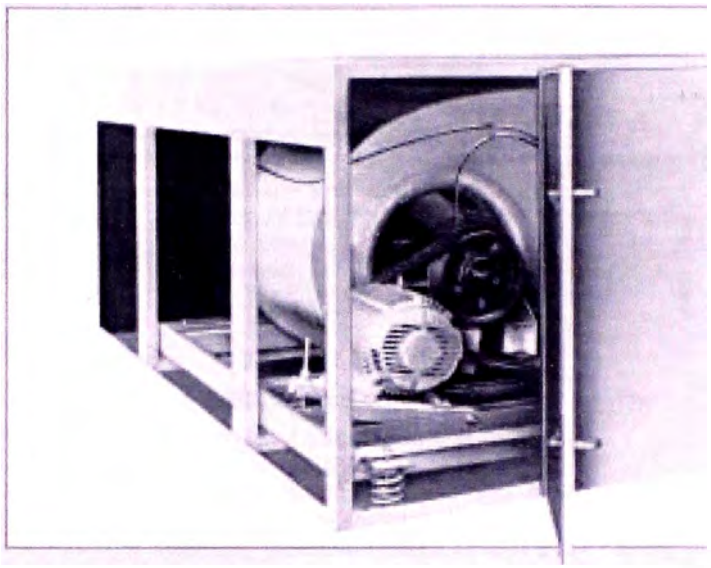
Coo ing

A FULL LIN OF ARI CERTI I D COIL

McQuay

13600 Industrial Park Boulevard, P.O. Box 1551, Minneapolis, MN 55440 USA 612/553-5330

Catalog 500-10



Central Station Air Handlers

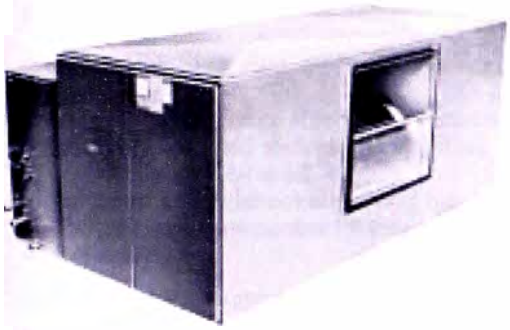
ARI certification of this unit does not include certification of the installed coil. Coil performance may be ARI certified separately.

ARI certified coils are offered for McQuay Central Station Air Handlers.

McQuay
Air Conditioning

SeasonMaster draw-through central station air conditioning units

LSL horizontal unit



LSL vertical unit

Type LSL low pressure units

- 15 horizontal, 13 vertical unit sizes
- 700 cfm to 50,000 cfm
- 1.8 sq. ft. to 70.4 sq. ft. coil face area
- Total static pressure up to 3.5" W.G.
- Internally mounted motors for unit sizes having 14 sq. ft. and over coil face area
- Selection of fan wheel sizes and types for all units
- Optional inlet vane control for forward curved or airfoil fans
- ARI certified

Type MSL medium pressure units

- 13 horizontal and 10 vertical unit sizes
- 2,000 cfm to 60,000 cfm
- 5.9 sq. ft. to 96.8 sq. ft. coil face area
- Total static pressure up to 6.5" W.G.
- Internally mounted motors for unit sizes having 14 sq. ft. and over coil face area
- Selection of fan wheel sizes for all units
- Optional inlet vane control for forward curved or airfoil fans
- ARI certified

Type HSH high pressure units

- 7 horizontal unit sizes
- 5,000 cfm to 41,000 cfm
- 13.4 sq. ft. to 62.8 sq. ft. coil face area
- Total static pressure up to 9.0" W.G.
- Optional inlet vane control for airfoil fans
- ARI certified

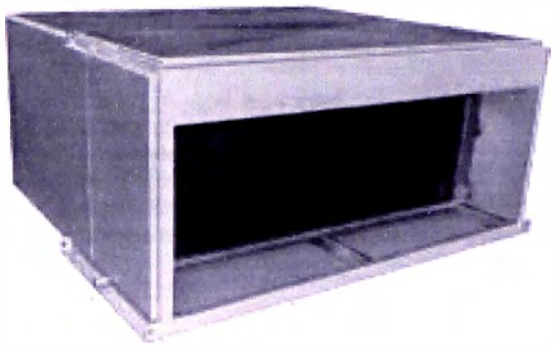
A complete air handler line to meet your exact building design requirements.

SeasonMaster blow-through central station air conditioning units

Type LSB & MSB singlezone units

- 13 LSB low pressure and 12 MSB medium pressure unit sizes
- 1800 cfm to 50,000 cfm
- 3.9 sq. ft. to 70.4 sq. ft. coil face area
- Total static pressure up to 3.5" W.G. (LSB) and 6.5" W.G. (MSB)
- Vertical or horizontal discharge, horizontal or inverted intake
- Optional perforated or solid liners for coil or diffuser section
- Internally mounted motors for unit sizes having 14 sq. ft. and over coil face area
- Selection of fan wheel sizes and types for all units
- Optional inlet vane control for forward curved or airfoil fans
- ARI certified

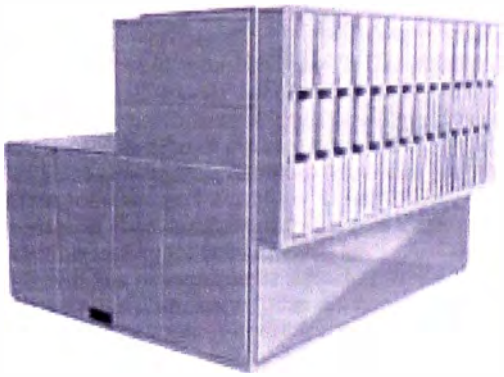
LSB blow-through singlezone



Type LML & MMM multizone units

- 13 LML low pressure and 12 MMM medium pressure unit sizes
- 1,800 cfm to 50,000 cfm
- 3.9 sq. ft. to 70.4 sq. ft. coil face area
- Total static pressure up to 3.5" W.G. (LML) and 6.5" W.G. (MMM)
- Two or three deck configurations with or without zone dampers
- Vertical or horizontal discharge, horizontal or inverted intake
- Optional perforated or solid liners for coil or diffuser section
- Internally mounted motors for unit sizes having 14 sq. ft. and over coil face area
- Selection of fan wheel sizes and types for all units
- Optional inlet vane control for forward curved or airfoil fans
- ARI certified

LML 3-deck multizone



Type HMH high pressure multizone

- 7 units sizes
- 5,000 cfm to 41,000 cfm
- 3.4 sq. ft. to 62.8 sq. ft. coil face area
- Total static pressure up to 9.0" W.G.
- Vertical or horizontal discharge, horizontal or inverted intake
- Optional inlet vane control for airfoil fans
- ARI certified

Contents

SeasonVent heating and ventilating units

LYF horizontal ventilating unit

Type LYF ventilating & LHD heating units

- 15 horizontal, 11 vertical and 11 inverted unit sizes
- 700 cfm to 56,000 cfm
- 1.8 sq. ft. to 62.8 sq. ft. coil face area
- Total static pressure up to 3.5" W.G
- Optional condenser/reclaim coil section
- Internally mounted motors for larger unit sizes
- Selection of fan wheel sizes and types for all units
- Optional inlet vane control for forward curved or airfoil fans
- ARI certified

ARI certification

ARI certification of this unit does not include certification of the installed coil. Coil performance may be ARI certified separately.

ARI certified coils are offered for McQuay central station air handlers.

McQuay air handlers are tested and rated in accordance with Air Conditioning and Refrigeration Institute (ARI) Standard 430 and certified in accordance with the ARI Certification Program. McQuay air handler coils are certified under ARI Standard 410, a separate performance certification program.

To obtain ARI certification of performance ratings, it is first necessary to have the testing facilities reviewed for proper instrumentation, control and accuracy of test data.

An air handler is then submitted to an ARI approved independent testing facility for comparative tests. ARI then approves the air handler manufacturer's testing facilities. After the testing facilities are approved, the air handler is tested over a wide range of operating conditions. All rating data is then reviewed by ARI engineers for accuracy and confirmation that procedures established by ARI have been followed. Periodic check tests of production air handlers by ARI on a random basis assures compliance with ARI standards.

Nomenclature

L SB - 1 14 - E I

BLOWER SECTION PRESSURE CLASS
- L = Low
- M = Medium
- H = High

COIL SECTION TYPE & PRESSURE CLASS
- YF = No coil section
- HD = Heating coil section
- SL = Draw-through, singlezone, low pressure
- SH = Draw-through, singlezone, high pressure
- SB = Blow through, singlezone, low & medium pressure
- ML = Blow-through, multizone, low pressure
- MM = Blow-through, multizone, medium pressure
- MH = Blow-through, multizone, high pressure

NUMBER OF FANS

NOMINAL COIL FACE AREA (Sq.Ft.)

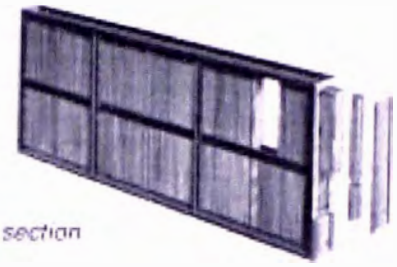
UNIT VINTAGE

UNIT ARRANGEMENT
- H = Horizontal
- V = Vertical
- I = Inverted

A complete line of accessories for maximum flexibility

Filter options

To address indoor air quality concerns, a complete line of McQuay air handling filter options is offered. Filter sections are available to house throwaway, pleated, cleanable, high velocity, rigid, bag, HEPA and roll filter media. Each section is compactly designed with a maximum filter area for proper air cleaning over the full range of unit air volume. Quick opening access doors on both ends of the filter sections simplify servicing.



Flat filter section

Combination angular filter and mixing box

Ideal for installations where equipment space is at a premium, this compact section combines the advantages of an angular filter section and a mixing box. Standard sized 2-inch thick filters are accessible from either end through hinged and latched access doors.

This accessory provides a simplified means of introducing and accurately modulating any desired ratio of recirculated and fresh air. The interconnected parallel acting blades are positioned so as to direct the two airstreams into a merging pattern to assist in mixing. Stratification is thereby minimized, assuring reduced danger of coil freeze-up.

The entire assembly is of heavy-gauge galvanized steel construction with the damper rods rotating in low friction nylon bushings for trouble-free operation. Damper sections are generously flanged for easy duct connections and are available with any single or combination of top, bottom or back openings.

All McQuay mixing boxes and combination angular filter/mixing boxes are provided with low leak dampers as standard. These dampers are tested in accordance with the Air Moving and Control Association (AMCA) Standard 500-83 to have a leakage rate of less than two-tenths of one percent leakage at two inches total static pressure differential.

Angular filter section

Combination angular filter & mixing box

Electric heat sections

Electric heaters are available for either blow-through or draw-through units. They can be located in a preheat or reheat position and are available with either remote or built-in control systems. Our electric heaters are open coil type, standard with 80% nickel and 20% chromium wire, and have been derated to insure maximum life. See Catalog 530 for full details.

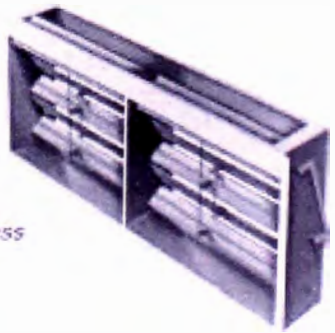
Electric heat

Face and bypass dampers

The face and bypass damper section offers modulation for temperature control. The opposed blades meter varying air volumes through the coil and bypass to attain the final air temperature demanded.

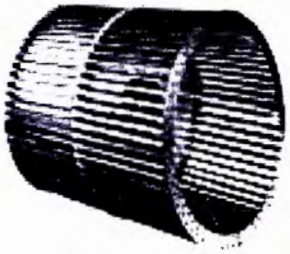
Two styles of face and bypass sections are available. Internal bypass is available for use with small face area coils and external bypass is used when larger face area coils are required. The external bypass duct is fully insulated with 1-inch neoprene coated glass fiber insulation and is sized to handle 100% air bypass with an air pressure drop approximately equal to that of a 10-fin, 4-row coil with "C" wetness.

The damper section and blades are fabricated of continuous galvanized steel with the damper rods rotating in nylon bushings. Damper shaft extensions are supplied on both ends to facilitate damper motor location.



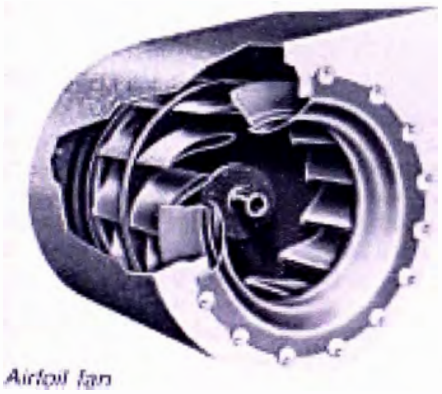
Face and bypass

Design features for energy economy and long life

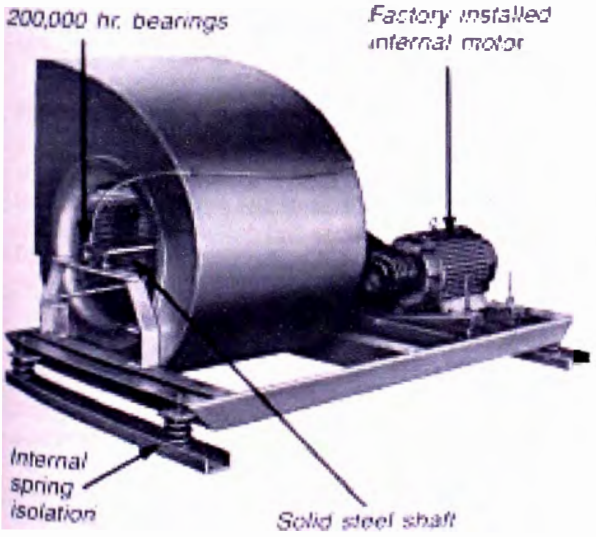


Forward curved fan

Airfoil fan



Airfoil fan



Fan wheels

As today's energy costs continue to spiral upward, it is becoming increasingly more important to maximize air handling system efficiency. This challenge is met by offering a combination of up to six different fan wheel diameters and types in today's most commonly used air handler sizes, i.e., McQuay low and medium pressure central station air handlers, sizes 114 through 172. This flexibility allows you the ability to select the most efficient fan for the system, whether it be Class I forward curved, Class II forward curved, or airfoil wheel.

Forward curved fan wheels are standard on all low and medium pressure units except the MSL-190. Airfoil wheels are optional on all low and medium pressure units, sizes 106 through 172 and the MSL-190. All high pressure units utilize airfoil wheels as standard. All fan wheels are dynamically balanced and the entire fan section is again trim balanced after assembly to assure smooth operation.

Air volume control

In order to meet the needs of an ever growing variable air volume market, two different methods of fan volume modulation are offered.

Inlet guide vanes are available for use with forward curved fans on unit sizes 106 through 134 and airfoil fans on unit sizes 114 through 190. Units equipped with variable inlet vanes include heavy-duty linkage for easy installation of field supplied vane actuator motor.

Discharge dampers are available for use with forward curved fans. Discharge dampers are shipped separately for field installation at least three fan diameters downstream for minimized noise and air turbulence. Discharge dampers have opposed blades in a vertical configuration closely matched to the fan outlet area.

Internal Isolation

To reduce both installation time and installed cost, internal isolation is now available as a standard option on the most popular of the McQuay air handling units, sizes 114 through 172 low and medium pressure. For the engineer, this means less time spent selecting and sizing vibration isolators for each air handling unit on the job. For the contractor, it not only eliminates the need for vibration eliminators on the coil piping and flex connections on the ductwork, but also eliminates the problems associated with jobsite coordination needed to get the correct isolator under the specific corner of the right unit at the time needed. Internal isolation assures the owner that the proper isolator selection has been made. The use of 2-inch deflection spring isolators means smooth vibration free air handler operation.

Factory installed internally mounted motor

All McQuay low and medium pressure central station air handling units (sizes 114 through 172) have factory installed internally mounted motors and drives. This means that expensive jobsite coordination and field mounting of motors has been eliminated.

Motor life is increased with the McQuay air handling units since the motor is operating in an environment of cooled dehumidified filtered air. And since the only heat gain with an internally mounted motor and drive is due to motor inefficiency and drive losses, there is seldom a need for an increase in cooling capacity and never a need for an increase in heating capacity.

Heavy-duty galvanized construction

McQuay air handler fan sections are designed using proven structural principles. Heavy-gauge channel and angle members are located and welded together to support the rotating assembly and motor, transmitting their static and dynamic forces directly to the base. All frame members are sized for the highest speeds, pressures and weights encountered. All channels, angles, and panels are fabricated of continuous galvanized steel.

Solid steel shafting

All fan shafts are of uniform diameter, ground and polished, solid steel and coated with rust inhibitor. Shaft sizes are selected to insure maximum operating speeds well below the first critical speed.

200,000 hour bearings

Trouble-free service and minimum noise level is the quality specification for selection of bearings used on McQuay air handlers. Rigidly supported on heavy-gauge structural frame members and located for proper balance, the bearings are sized for a minimum average life rating of 200,000 hours. Bearings are self-aligning type and are prelubricated for immediate service. Extended lubrication lines with grease fittings external to the cabinet are a standard feature, assuring ease of service, except for MSL190.

Cooling coil sections

To assure maximum flexibility, three standard face area coils — small, large and extra large — are available on low and medium pressure units, thereby permitting the selection of the most economical heat transfer surface.

Draw-through units will accommodate combinations of preheat, cooling and reheat coils with a maximum of an 8-row cooling coil and a 2-row heating coil or a 6-row cooling coil and two 1- or 2-row heating coils.

Blow-through singlezone units will also accommodate a maximum of an 8-row cooling coil and 2-row heating coil or a 6-row cooling coil and two 1- or 2-row heating coils. Blow-through multizone units will accommodate an 8-row cooling coil and a 4-row heating coil, and feature a factory installed balancing plate to assure equal air distribution over the hot, cold (and bypass) decks.

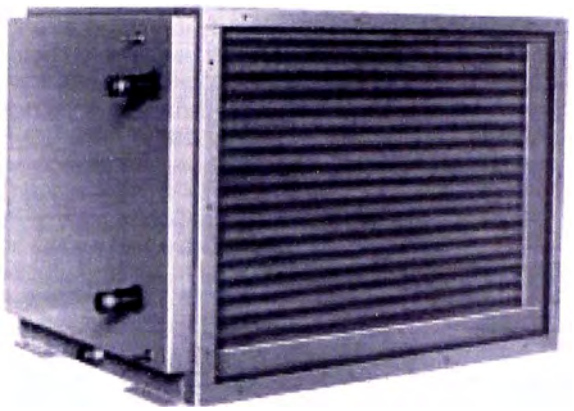
Stand-alone type LSC coil sections are available for applications where a cooling coil is required with fan supplied by others, or where additional coil sections are desired. The LSC coil section is identical in design and construction to LSL/MSL 103—172 cooling/heating coil sections.

Heating coil sections

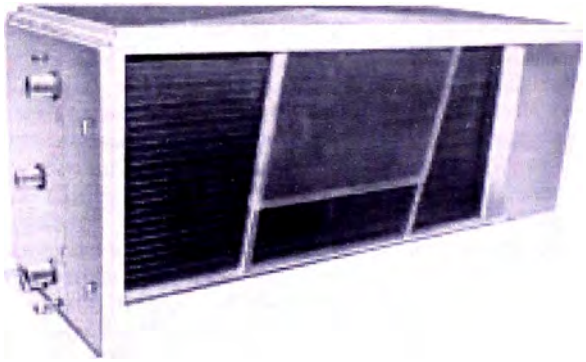
A separate coil section with large or small face area coils is available for preheat or reheat applications. This coil section is standard on type LHD Seasonvent heating and ventilating units. Separate heating coil sections are available in two configurations to accommodate 1- and 2-row coils or 3- and 4-row heating coils.

Sloped drain pan

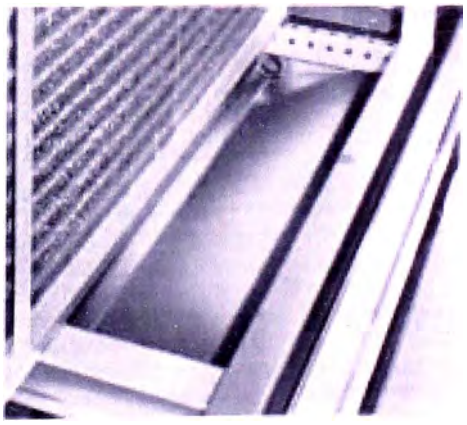
All McQuay indoor air handling units (with the exception of the high pressure multizone unit) are provided with a sloped drain pan in the coil section. It is provided with a minimum slope of ⅛" per linear foot to prevent standing water in the drain pan. The sloped drain pan feature is provided with dual drain connections, one located on each side of the unit. This allows the customer the flexibility to connect condensate piping to either or both sides of the unit. Both drain connections are positioned at the lowest point of the drain pan to assure drainage.



Draw-through cooling coil section



Blow-through singlezone coil section



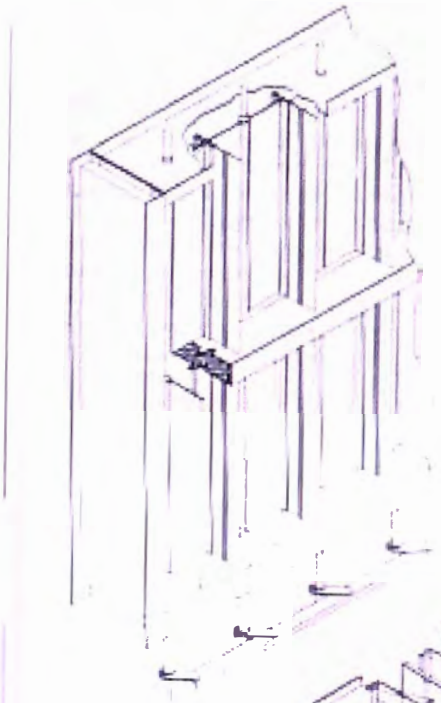
Sloped drain pan

The drain pan is visible for inspection and cleaning from the leaving air side of the coil. The drain pan can be cleaned without removing the coil. The drain pan is completely coated with baked enamel paint. An optional stainless steel drain pan is also available. A complete thickness of insulation (whatever is specified throughout the unit) is provided underneath the drain pan.

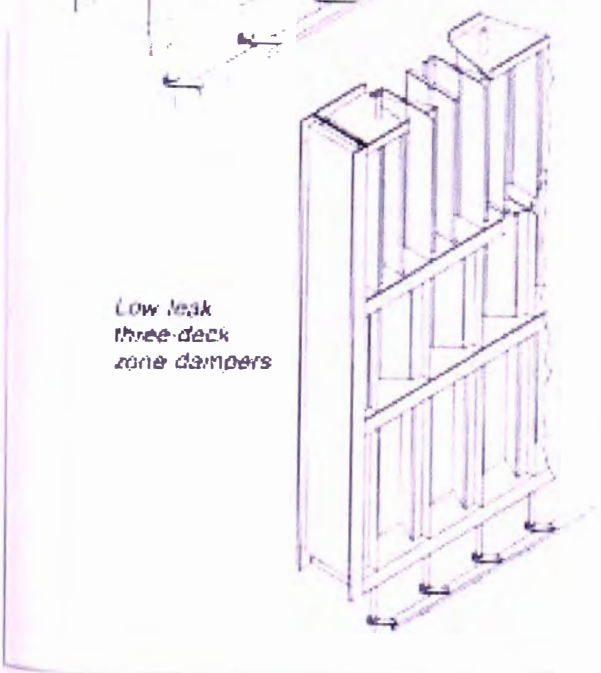
Low leak mixing box dampers

UltraSeal™ mixing box dampers

UltraSeal low leak dampers are standard for all McQuay mixing boxes and combination filter/mixing boxes equipped with dampers. UltraSeal maximizes energy savings by providing the lowest mixing box damper leakage rate in the industry. At 4.0" W.G. static pressure and 1,100 fpm face velocity through the companion set of dampers, the UltraSeal low leak dampers have a 0.2% leakage rate. Although it is common practice to specify leakage rates at higher static pressures, mixing box dampers should not exceed 2.0" W.G. under normal operations. Dual durometer gasketing and stainless steel end seals provide this impressive seal. The insulated core airfoil blade design offers low air friction and improved insulating capability. A patented blade linkage results in smooth operation. A 160" stroke rotary electric actuator can handle up to 40 sq. ft. of damper. For pneumatic actuators, allow 5 in. lb. per square foot of damper area.



Low leak two-deck zone dampers



Low leak three-deck zone dampers

UltraSeal™ zone dampers

McQuay low and medium pressure multizone air handlers feature low leak zone dampers as standard. The low leak design features extruded aluminum blades with bronze side seals and end seals on hot and cold decks to maintain energy efficiency throughout the operating life of the air handler.

Damper blades are parallel acting within individual partitions to provide smooth, accurate control. Hot, cold and bypass dampers are locked in position on a common damper rod rotating in bronze bushings. On three-deck units the dampers rotate through full heating, heating/bypass, full bypass, bypass/cooling and full cooling through a rotation angle of 90 degrees. This unique design requires only one actuator motor to operate the dampers for all three decks of each zone. Two-deck unit zone dampers are similar.

All dampers are interconnected externally with a single rod to permit easy on-the-job zoning. Duct-to-damper connections are simplified due to wide duct flanges and duct clips at the zone partitions.

Double wall construction

McQuay IAQ air handling units have solid galvanized sheet metal liners that allow for unit cleanability and prevent fiberglass insulation from entering the airstream. The solid liners have been designed to eliminate all gaps exposing insulation, and assures that no fibers will be released into the airstream and no internal moisture will penetrate the insulation to support microbial growth. In addition, thermal barriers are provided in the conditioned sections of the unit. This insures that there are no continuous metals to conduct heat into the unit, and minimizes the possibility of condensate forming on the outside of the unit.

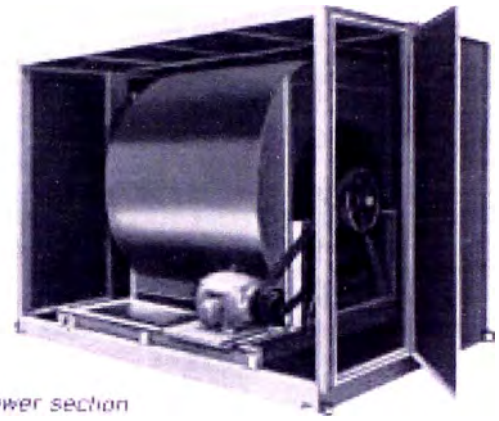
The double wall construction units are provided with 2" 1 ½ lb. density fiberglass insulation as standard. The insulation is completely encapsulated between the liner and outer panels, and is consistently applied throughout the unit. Full 2" thick insulation is applied under the unit drain pan where cabinet temperatures are the coldest.

Double wall construction is available for fan, draw through and blow-through singlezone coil, filter, auxiliary coil, combination filter mixing box, access, diffuser, face and bypass and adapter sections.

MSL-190 for large air handling applications

Blower section

The McQuay MSL-190 draw-through unit accommodates large air handling applications. Blower sections are internally isolated as standard. Three airfoil fan options, with or without inlet vanes, provide application flexibility from 20,000 to 60,000 cfm. Two access doors on each side (four total) allow service access unmatched in the industry. Solid steel shafts, high quality ball bearings, and heavy-gauge galvanized steel construction result in long trouble-free performance. ARI certification assures confidence in equipment selection.



Blower section

Coil sections up to 96.8 sq. ft.

Three coil section types provide application flexibility from 48.4 sq. ft. to 96.8 sq. ft. coil face area. Single coil sections are available with or without face and bypass. Wide coil sections accommodate larger face areas with no space penalty in the direction of airflow. Staggered coil sections provide the largest face area options with or without face and bypass. All coil sections feature the McQuay sloped drain pan. Hinged access doors are provided on both single and staggered coil sections. Removable panels provide access to wide coil sections.

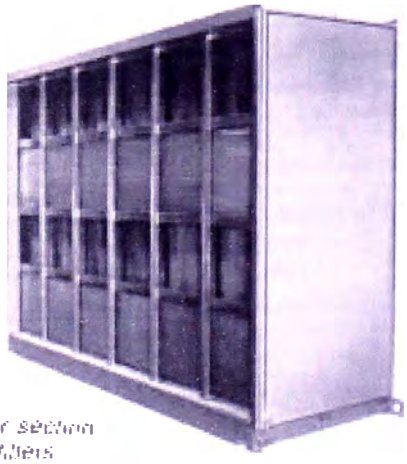
Wide coil section

Full line of accessories

MSL-190 accessories include filter sections, mixing boxes, and access sections. Three filter types are accommodated by the basic filter section. By altering the internal configuration this section will house throwaway, bag or rigid filters. Angular racks provide large filtration face areas for 2" throwaway, pleated or cleanable filters. The vertical rack configuration accommodates bag or rigid filters with or without throwaway prefilters. Full size hinged access doors are standard on all filter sections.

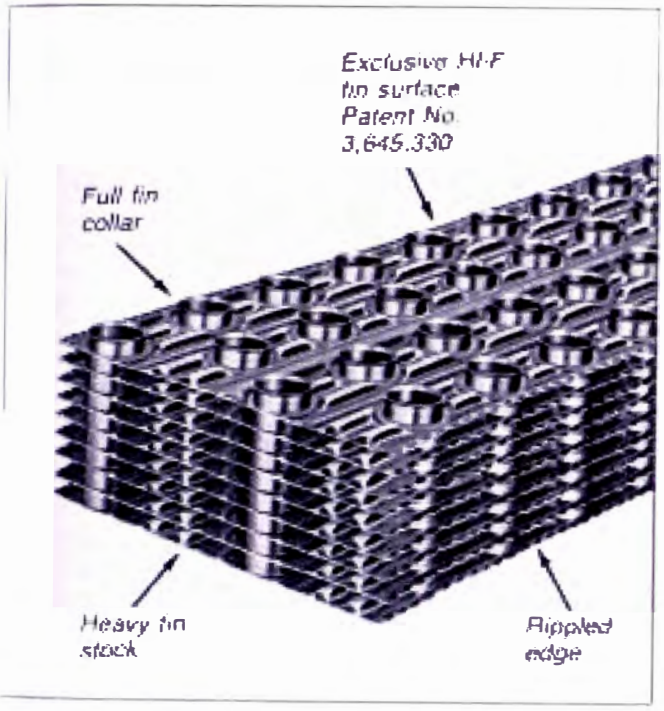
Mixing box sections are furnished with UltraSeal low leak hollow airfoil dampers as standard. UltraSeal dampers provide the ultimate in energy economy, minimum air friction and reduced damper actuator torques. Two hinged access doors on each side (four total) provide unmatched access.

Access/spacer sections allow unit arrangement flexibility. These sections, as well as blower, coil, filter and mixing box sections are constructed of heavy-gauge galvanized steel for exceptional durability. Full size hinged access doors are provided on each side.



Bag filter section with prefilters

A pioneer in corrugated fin development



McQuay HI-F means HI-Efficiency

A principal factor governing fin heat transfer efficiency is the boundary layer film of air adhering to any fin surface. This boundary layer insulates the fin, severely reducing the rate of heat exchange.

The advanced rippled-corrugated HI-F design creates a state of continuous turbulence which effectively reduces the boundary layer formation. The exclusive rippled edge instantly deflects the incoming air to create initial turbulence. A succession of corrugations across the fin depth, in conjunction with the staggered tubes, increases the turbulating effect and eliminates the "dead spots" behind the tubes. In this manner, the McQuay HI-F design establishes a new high in heat transfer efficiency, yielding sharply increased performance. The rippled fin edge also strengthens the fin edge and provides a pleasing overall appearance.

McQuay E-F means Energy Efficient

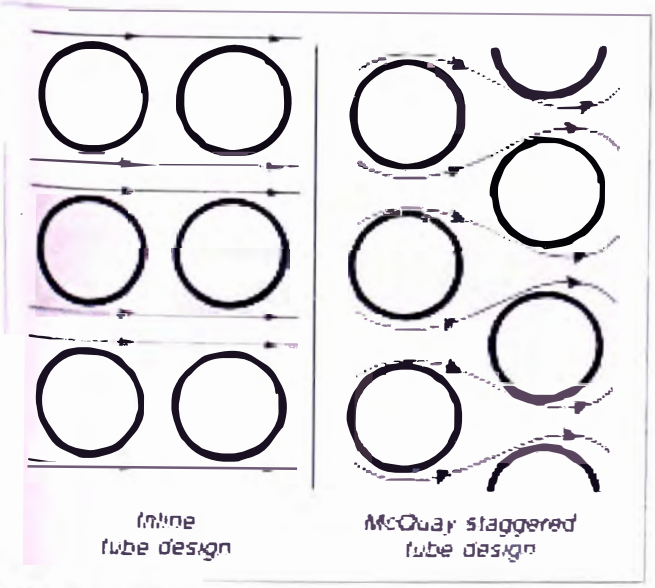
The term "energy efficient," which is used to describe how well a system utilizes energy, is becoming a common expression in the HVAC industry.

With costs of energy rising, the need for cutting operating expenses is apparent. Lowering the air pressure drop across the face of the coil will reduce the bhp and kw requirements of the system. The McQuay E-F fin surface meets this need with its smoother fin design, resulting in lower operating costs over the life of the equipment.

ARI certified coils are offered for use in McQuay central station air handlers.

McQuay coils are ARI certified

McQuay standard coils, with an unmatched variety of fin spacing, row and circuiting combinations, can accurately meet the load requirements and fully achieve the desired results in the conditioned space. Furthermore, the McQuay MS-85™ Microcomputer Selection Program can be used to match the optimum coil to the best air handler size. McQuay coils and the MS-85™ Coil and Air Handler Selection Programs are ARI certified to assure full rated performance.



McQuay staggered tube design means high performance

The more moving air in contact with the tubes of the coil, the more performance obtained from the total available surface. The staggered tube design exposes the tubes to more moving air than the in-line design.

The geometry of the staggered design allows the rows to be spaced closer together. This results in a more compact coil providing higher capacities. The combination of rippled fins and staggered tubes gives McQuay coils the performance and flexibility needed now and in the future.

For more information on McQuay coils, consult the following catalogs:

Cooling:
Water cooling/Evaporator cooling/Cleanable — Catalog 411

Heating:
Water heating/Booster heating/Cleanable — Catalog 412

Steam:
Standard/Distributing . . . . — Catalog 413

Water cooling coils

Water cooling coils, designated "4W," "5W," and "5M," are designed and engineered to meet the widest range of cooling applications. Realizing the need for variable coil circuiting to obtain optimum water velocities, McQuay coils offer flow-controlled circuiting in five standard counterflow arrangements. For complete information on water coil performance and operating conditions, see Catalog 411.

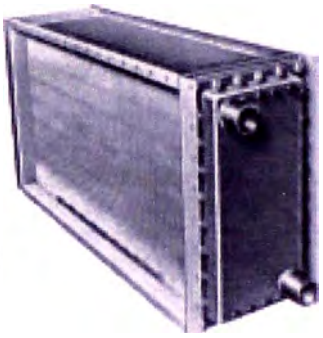
Water cooling coil

Cleanable coils

Removable header, cleanable, tube water coils are available where scaling or other water conditions require inspection and mechanical cleaning to maintain the original high coil efficiency. Three types of removable header coils are available:

1. "5K" coils have easily removable headers at both ends of the coils.
2. "5Q" coils have one removable header on the end opposite the supply connection.
3. "5P" coils have one removable header on the supply connection end.

All three types are available with five standard counterflow circuit arrangements as well as all the features of the standard water coil line. For complete information on coil performance and operating conditions, refer to Catalog 411.



Cleanable coil

Evaporator coils

A full line of evaporator coils, denoted by "5E," are available. Standard coils are available with flow-controlled circuiting for use with HCFC-22 and CFC-12 refrigerants. To assure maximum efficiency, each coil is equipped with pressure type brass distributors selected for the specified conditions. Consult Catalog 411 for complete information on coil performance and operating conditions.

Evaporator coil

Water heating coils

HI-F5 and E-F5 water heating coils are available, 1 through 4 rows with 06 through 14 fin series, in a variety of circuitings. McQuay heating coils are designated "4W," "5W," and "5M." Consult Catalog 412 for complete information on coil performance and operating conditions.

Steam coil

Steam heating coils

HI-F5 and E-F5 coils have ⅝" O.D. tubes and HI-F8 coils have 1" O.D. tubes. Model "5JA" steam coils have directionally orificed steam distributing tubes with supply and return connections at the same end. Model "8RA" jet tube steam distributing coils are similar to the "JA" coils except that the supply and return connections are located on opposite ends. Model "5SA" steam coils with ⅝" O.D. tubes are of standard construction, single tube and opposite end connections. See Catalog 413 for complete information on coil performance and operating conditions.

Condenser coil

Condenser coils

The condenser coil is constructed of ½" O.D. seamless copper tubes arranged in a staggered tube pattern with plate type, rippled aluminum fins. The fins completely cover the copper tubing and are mechanically bonded to the tubes. Copper headers and connections are sized for minimum refrigerant pressure drop. All coils are pressure tested, dehydrated and sealed with a holding charge of dry air for shipment. McQuay condenser coil ratings are not within the scope of the ARI certification program.

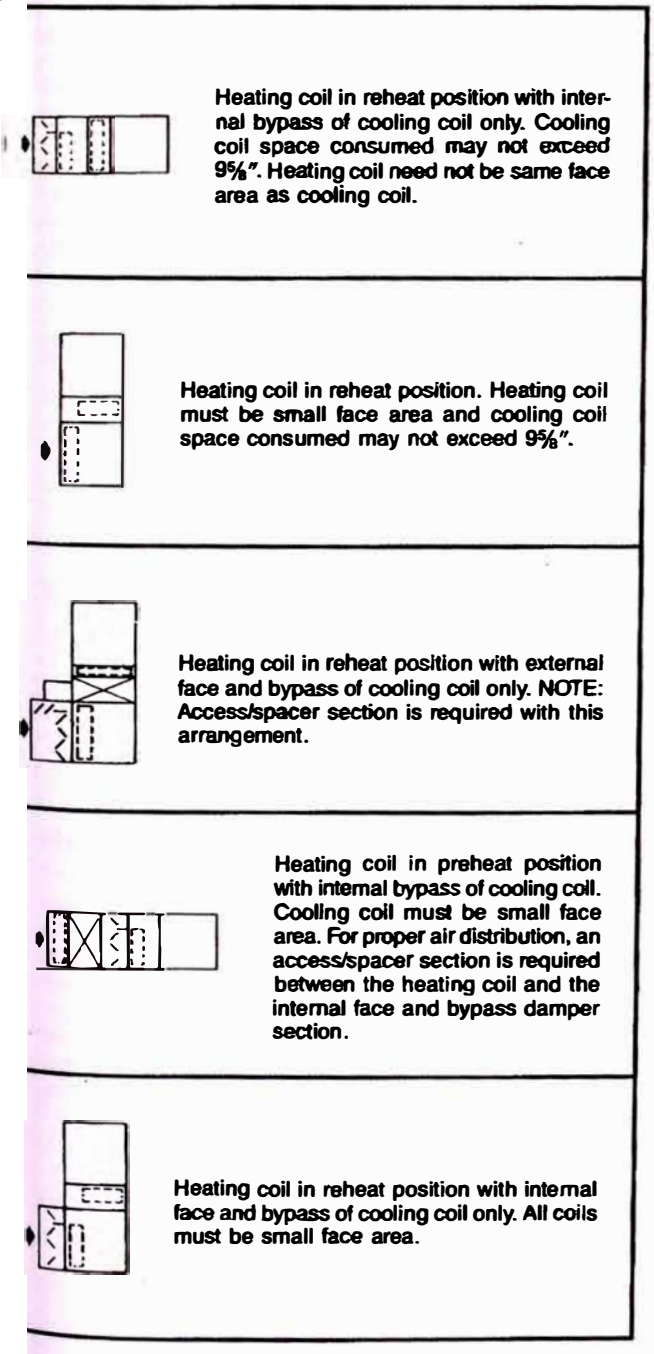
Unit coil information

able 1. Coil casing depth dimensions (inches)

ROWS	COIL TYPE					
	4W,4C 5W,5C	5M	5E	5K, 5P 5Q	5J, 5S 5G, 5H	8G, 8J 8R, 8T
1	4⅛	5½	—	4⅛	4⅛	4⅛
2	4⅛	6⅞	*6⅞	4⅛	4⅛	—
3	5½	—	5½	5½	—	—
4	6⅞	—	6⅞	9⅝	—	—
5	8¼	—	8¼	11	—	—
6	9⅝	—	9⅝	12⅜	—	—
8	12⅜	—	12⅜	15⅛	—	—
10	15⅛	—	15⅛	—	—	—

*EJ & 5EK are 8¼" in depth.

igure 1. Coil Location Limitations



Heating coil in reheat position with internal bypass of cooling coil only. Cooling coil space consumed may not exceed 9⅝". Heating coil need not be same face area as cooling coil.

Heating coil in reheat position. Heating coil must be small face area and cooling coil space consumed may not exceed 9⅝".

Heating coil in reheat position with external face and bypass of cooling coil only. NOTE: Access/spacer section is required with this arrangement.

Heating coil in preheat position with internal bypass of cooling coil. Cooling coil must be small face area. For proper air distribution, an access/spacer section is required between the heating coil and the internal face and bypass damper section.

Heating coil in reheat position with internal face and bypass of cooling coil only. All coils must be small face area.

Coil size limitations

McQuay coils are available in three sizes—small, large, and extra large—for most air handler unit sizes. The following guidelines apply to unit sizes 103 through 172. MSL-190 coil guidelines are presented separately.

1. All coils mounted in the same coil section must be of the same face area.
2. Extra large face area coils are not available for LHD heating units and some high pressure unit sizes. Note that extra large face area coil dimensions for blow-through unit sizes 114, 117, 122, 128, 137, 141 and 172 differ from those of the comparable draw-through unit sizes. Refer to the Physical Data section, pages 32 through 35.
3. All coils being bypassed using internal face and bypass dampers must have small face areas.

Coil depth limitations

Table 1 lists the depth (in direction of airflow) of the various types of McQuay coils offered. All dimensions are overall casing depth. The sum of the casing depths of all coils to be mounted in the same coil sections must not exceed the maximum space available.

The maximum coil depth available in standard coil sections is as follows:

Draw-through horizontal or vertical cooling coil section:
- Low & medium pressure units . . . . . 17⅞"
- High pressure units (117—128 sizes) . . . . . 17⅞"
- High pressure units (137—164 sizes) . . . . . 49⅛"

Singlezone blow-through cooling coil section:
- Horizontal discharge . . . . . 17⅞"
- Vertical discharge . . . . . 12⅜"
- Vertical discharge with cabinet extension . . . . . 17⅞"

Multizone blow-through coil section:
- Cold deck . . . . . 12⅜"
- Hot deck . . . . . 6⅞"

Heating coil sections:
- 1- and 2-row . . . . . 4⅛"
- 3- and 4-row . . . . . 6⅞"

LSL and MSL unit sizes 137 and 141, with small face area cooling coils, are not equipped with the intermediate drain trough. For this reason, the maximum space available with these units may be increased by 2¾".

LSL and MSL-172 units with heating coil only, cooling coil only, or when the cooling coil is second in the airstream have a maximum coil depth of 16½". When the heating coil is second in the airstream, the maximum depth is 13½". This restriction is necessary to maintain adequate airflow over the top portion of the coil.

MSL-190 coil considerations

The three MSL-190 coil sections — single, staggered and wide — can each house a range of coil face areas. Coil face area options are presented in the Physical Data section, page 36. The maximum coil depth (in direction of airflow) for all coil sections is 30" without face and bypass. Single and staggered coil sections equipped with face and bypass are restricted to a maximum coil depth of 23".

Condenser/heat reclaim coil selection

There are many applications which require year-round operation of air cooled condensing equipment. Typical examples include supermarkets, restaurants, refrigerated food warehouses and data processing rooms.

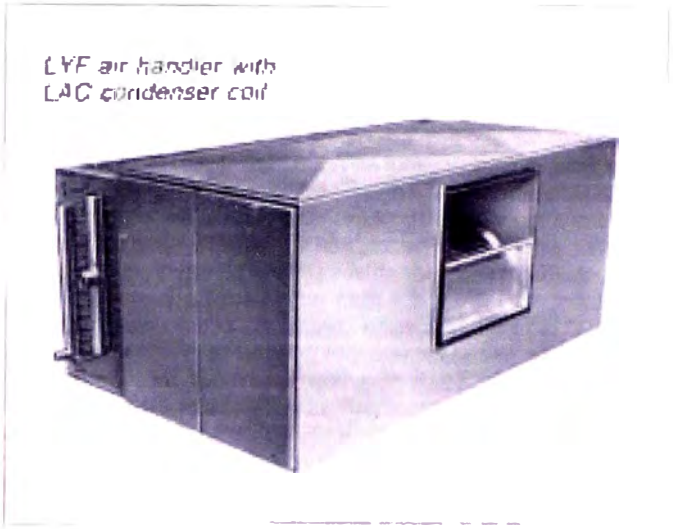
In the past, it has been general practice to waste the heat energy developed in the refrigeration process by discharging it into the atmosphere. This wasted heat is significant and, in many instances, the utilization of it can mean substantial savings in fuel cost.

McQuay condenser coils may be ordered in many ways. LAC cased coils are sized to fit directly to LYF fan sections. This LAC casing allows the use of most AHU accessories.

Condenser coils may also be used with standard units in the preheat or reheat positions. Coils may be selected to be used in full condensing applications or for partial condensing (heat reclaim) with a remote condensing unit.

With the wide selection of AHU accessories such as face and bypass or variable inlet vanes, a number of economical means may be used for head pressure control. (Refer to Catalog 630 for more information concerning head pressure control.)

In cases where heat must be rejected to the atmosphere, the condensing air handler may be used to satisfy building exhaust requirements. Since the unit must normally be operated, the exhaust feature is obtained with virtually no added expense.



LYF air handler with LAC condenser coil

Selection procedure

1. Determine the total heat rejection required at the condenser for the desired net refrigeration effect at the evaporator. If the compressor manufacturer does not publish heat rejection ratings, factors from Tables 3 and 4 may be used to estimate the Total Heat of Rejection (THR). For heat reclaim applications determine the amount of heat to be reclaimed by the air handler reclaim coil.
2. Establish the design entering air temperature, entering refrigerant temperature, refrigerant type, airflow cfm and degree of subcooling (if any). A typical condenser coil face velocity is 600 fpm.
3. Contact your local representative to obtain a selection customized to your requirements.

Head pressure control

The capacity of a condenser coil varies with the difference between the entering air dry bulb temperature and the condensing temperature of the refrigerant. The lower limit of the head pressure is dependent upon the required pressure drop across the thermostatic expansion valve. For normal air conditioning applications, head pressure control is not required for ambient air temperatures above 60°F. When condenser operation is required at ambient air temperatures below 60°F, head pressure control is required.

Table 2. LAC Coil Sizes

AIR HANDLER SIZE	COIL SIZE (IN.)	FACE AREA (SQ.FT.)	AIR HANDLER SIZE	COIL SIZE (IN.)	FACE AREA (SQ.FT.)
103	18 x 30	3.8	122	39 x 93.0	25.2
104	21 x 36	5.3	128	39 x 116.0	31.4
106	24 x 46	7.7	137	51 x 115.5	40.9
108	33 x 44	10.1	141	60 x 115.5	48.1
111	33 x 59	13.5	150	69 x 115.5	55.3
114	33 x 74	17.0	164	87 x 115.5	69.1
117	33 x 89	20.4			

Table 3. Approximate Heat Rejection Factors For Open Compressors

EVAPORATOR TEMPERATURE (°F)	CONDENSING TEMPERATURE (°F)					
	90	100	110	120	130	140
-30	1.27	1.42	1.47	*	*	*
-20	1.33	1.37	1.42	1.47	*	
-10	1.28	1.32	1.37	1.42	1.47	
0	1.24	1.28	1.32	1.37	1.41	1.47
10	1.21	1.24	1.28	1.32	1.36	1.42
20	1.17	1.20	1.24	1.28	1.32	1.37
30	1.14	1.17	1.20	1.24	1.27	1.32
40	1.12	1.15	1.17	1.20	1.23	1.28
50	1.09	1.12	1.14	1.17	1.20	1.24

*Outside of normal limits for single stage compressor application.

Table 4. Approximate Heat Rejection Factors For Suction Cooled Hermetic Compressors

EVAPORATOR TEMPERATURE (°F)	CONDENSING TEMPERATURE (°F)					
	90	100	110	120	130	140
30	1.57	1.62	1.68	*	*	*
20	1.49	1.53	1.58	1.63	*	
10	1.42	1.46	1.50	1.55	1.64	
0	1.36	1.40	1.44	1.49	1.58	1.67
-10	1.31	1.34	1.39	1.43	1.48	1.56
-20	1.26	1.29	1.33	1.37	1.43	1.49
-30	1.22	1.25	1.29	1.32	1.37	1.43
-40	1.18	1.21	1.24	1.27	1.31	1.36
-50	1.14	1.17	1.21	1.24	1.26	1.29

*Outside of normal limits for single stage compressor application.

Air handler selection data

Computerized air handler selection

The achievement of an efficient air handling system is dependent on accurate system design and proper equipment selection. Factors which control the unit selection include applicable codes, ventilation requirements, heating and cooling space loads, acceptable temperature differentials, thermal media and installation limitations. The selection of the unit can then be resolved in four steps: 1) unit type and size, 2) coils, 3) accessories, and 4) fan wheel type and motor horsepower.

The following paragraphs outline a suggested procedure for central station air handler selection. To obtain an optimal selection, use the MS-85™ Microcomputer Air Handler Selection Program. The selection program should be used with the following procedure to determine unit size, coil rows, fins and circuiting as well as motor horsepower requirements. Contact your nearest McQuay representative for a copy of the MS-85™ software or an air handler selection that meets your specifications.

Selection of unit type and size

With the overall system designed to minimize the number of units and the requirements of heating, cooling and ventilation for the various zones established, selection of the optimum unit size can be made based on the required air volume. The heating load, cooling load and ventilation requirement will establish an airflow requirement, any one of which may be the maximum.

The unit air volume for cooling is dependent upon the sensible space cooling load and the design dry bulb temperature differential. Normal temperature differentials for air conditioning are from 12°F to 25°F. The minimum air volume is solved using the following formula:

$$cfm = \frac{Sensible\ Space\ Load\ (Btuh)}{1.08 \times Temp.\ Differential}$$

Normal temperature differentials for heating are from 20°F to 50°F. The required minimum air volume for heating is solved by using the same formula. The required air volume for ventilation is generally less than that for cooling or heating. Where toxic fumes or unusual contaminants are encountered, the exhaust requirements may establish a minimum air volume in excess of that determined for cooling or heating.

The unit size can now be selected based on the maximum air volume required. Coil face velocity is usually the best parameter for unit size selection and the coil area will determine the unit size.

With the coil selections available, usually more than one unit and/or fan size can be selected to deliver the required air. Therefore, fan outlet velocity, fan speed and brake horsepower should also be considered in the final selection.

The fan performance curves and tables are found in Catalog 520. They are organized in an easy-to-use manner showing all fan sizes and types available for each unit type and size. Fan selection can also be made by using the ARI certified MS-85™ Air Handler Selection Program.

Selection of coils

The selection of a coil can be done in three steps:

1. The coil face area that will give the optimum face velocity.
2. The type of coil that will best suit the application.
3. The circuiting, number of rows and fin spacing that will satisfy the heating and/or cooling requirement.

The coil size should be selected for maximum face velocity to obtain peak heat transfer efficiency and minimum cost. For cooling coils, 400 to 600 fpm is generally considered the optimum face velocity range for dehumidification and no moisture carryover. For heating coils, the optimum face velocity range is 400 to 1200 fpm.

The coil type is determined by the specific application. Proper selection is dependent upon the choice of thermal medium and associated data such as temperature, quantities available and thermal properties. Types of coils available are discussed on pages 10 and 11. For blow-through units using steam heating coils, experience has shown that jet tube steam distributing coils (type 5J or 8J) provide the best temperature distribution over the face of the coil.

Determination of coil circuiting, rows and fin spacing is based on the cooling or heating requirements. For units with internal fan motors, the motor heat gain must be considered in the cooling and heating loads. Fan motor heat values are shown in Figure 11, page 24.

For more information about McQuay water cooling, evaporator, water heating and steam coils, refer to Catalogs 411, 412 and 413. Coil selections for central station air handlers should be made by using the MS-85™ Air Handler Selection Program.

Selection of accessories

A complete line of accessories is available to insure proper cleaning, mixing and temperature control of the air.

For proper air cleaning, the filter section should be selected to provide filter area such that the filter velocity will be compatible with the choice of filter media. Three types of filter sections—flat, angular and heavy-duty—provide a full range of filter capacities for each unit size. Bag, roll, rigid and HEPA filter sections are also available.

For air mixing, dampers provide a simple means of introducing outside air with thorough mixing and proportional control of the recirculated and fresh air. A mixing box or combination angular filter/mixing box is available for each unit size. Mixing box dampers feature McQuay Ultra-Seal low leak dampers as standard.

Dampers are also often selected as an effective means of temperature control because they provide close control without time lag. Face and bypass dampers are provided for singlezone units and zone dampers are available for multizone units. The face and bypass dampers are available with an internal bypass duct (used with small face area coils only) or with an external bypass duct. Low leak zone dampers are standard on all multizone units equipped with dampers.

Selection of fan wheel type and motor

Fan motor size is dependent on fan brake horsepower which, in turn, is a function of fan performance. Fan performance determination requires an accurate calculation of the resistance to airflow through the entire system. This total resistance consists of the sum of two parts — the external static pressure of the distribution system and the internal unit resistance. External static pressure is a function of the supply and return ductwork along with any damper or other equipment external to the air handler.

The internal unit resistance is found by summing the resistances of the coils and various unit components and accessories. Component resistances are tabulated in Table 5 on page 16. On multi-zone or double duct units, the resistance value of only one coil is used, the higher of either the cooling or heating coil.

Having determined the total static pressure, the fan speed and brake horsepower can be determined from the MS-85™ Air Handler Selection Program or the fan performance curves found in Catalog 520.

Example selection

General requirements

Minimum outside air requirements . . . . . 210 cfm
Summer design conditions:
- Outdoor design temperature . . . . . 95°F DB/77°F WB
- Required sensible heat ratio 0.90
- Required sensible building load 183, 120
- Desired space temperature . . . . . 75°F DB/63°F WB
- Supply air temperature . . . . . 55°F DB
- Mixed air temperature . . . . . 80°F DB/67°F WB

Winter design conditions:
- Outdoor design temperature . . . . . 10°F DB
- Required heating capacity 280,000
- Desired space temperature . . . . . 70°F DB
- Supply air temperature . . . . . 105°F DB
- Mixed air temperature . . . . . 50°F DB
- External static pressure 1.2

Unit arrangement . . . . . Horizontal draw-through with preheat coil
Accessory arrangement . . . . . Combination angular filter and mixing box with throwaway filters

Selection of unit size

Calculate the cfm required for cooling and for heating:

a) $Cooling\ cfm = \frac{Sensible\ Space\ Load}{1.08 \times (Mixed\ Air\ Temp. - Supply\ Air\ Temp.)}$

$= \frac{182,120}{1.08\ (80-55)} = 6782\ cfm$

b) $Heating\ cfm = \frac{Sensible\ Space\ Load}{1.08 \times (Supply\ Air\ Temp. - Mixed\ Air\ Temp.)}$

$= \frac{280,000}{1.08\ (105-50)} = 4713\ cfm$

The cooling load requires the most air to satisfy the space conditions, so 6782 cfm should be used to select the unit. The selection of unit size depends on the air face velocity over the coil. The required cfm is 6782 and, using a design parameter of 500 fpm face velocity, the required coil size is 13.6 sq.ft. From pages 34 and 35, model LSL-114 with large face area coil has a coil size of 13.7 sq.ft. The extra large face area coil could be selected as an option to reduce coil face velocity for lower coil air friction.

Selection of the coil

McQuay's wide variety of circuiting, row, and fin spacing assures a coil selection that will handle the load requirements. All air handler coils sould be selected by using the MS-85™ Air Handler Selection Program. Contact your nearest McQuay representative for a copy of the software or an air handler selection tailored to your application.

Determination of total static pressure

The external static pressure is given as 1.2" and the internal losses of the unit must now be calculated. Calculation of internal static pressure is done automatically by the MS-85™ Air Handler Selection Program. Internal static can also be calculated by hand as follows.

The pressure loss of the angular filter mixing box can be found under component losses on pages 16 and 17. In the example, the angular filters will have a maximum air pressure drop of 0.09" and the filter mixing box will have a maximum pressure drop of 0.04".

The cooling coil air friction loss can be determined by entering on the appropriate chart on page 18 or 19. Plot the coil face velocity at the bottom of the chart (Point ①). From this point, draw a line diagonally upward to the appropriate degree of wetness (Point ②). Beginning with this point, draw a line vertically up to the fin series selected (Point ③). Now continue the line horizontally to either the right or left to the appropriate number of rows (Point ④ or ⑤) and read the air pressure drop directly from the chart.

For example, the air friction is 0.82 for a 5-row HI-F5 coil with 10 fins per inch and "C" degree of wetness. The heating coil air pressure drop is estimated in much the same way, with the exception of the various degrees of wetness. For example, the air friction is 0.11 for a 1-row, 6 fins per inch coil.

Adding:
- External . . . . . 1.20"
- Filter . . . . . 0.09"
- Cooling coil . . . . . 0.82"
- Heating coil . . . . . 0.11"
- Mixing section . . . . . 0.04"
- Cabinet loss . . . . . *

Total . . . . . 2.26"

*Cabinet losses for horizontal units are allowed for in the fan performance tables.

Selection of fan wheel

Factors involved in selecting the fan include fan speed, brake horsepower, sound, and first cost. The Air Handler Selection Program output includes all of the above factors for the various fan wheels available in each unit size.

Fan performance can also be determined from Catalog 520. For example, the LSL-114 with standard forward curved fan will operate at 840 rpm and 4.0 bhp for 6782 cfm against 2.26" TSP. A 5.0 horsepower motor would be required to operate the unit. See Table 7 on page 24 for temperature and altitude correction factors if they are required.

General formulas

1. Total Btuh (Airside)

$Total\ Btuh = 4.5 \times cfm \times (Total\ Heat\ Ent.\ Air - Total\ Heat\ Lvg.\ Air)$

Where: $4.5 = Density\ Std.\ Air \times Min./Hr$
$Density\ Std.\ Air = 0.75\ lbs./cu.ft.$
$Min./Hr. = 60$

2. Total Btuh (Waterside)

$Total\ Btuh = 500 \times gpm \times (Lvg.\ Water\ Temp. - Ent.\ Water\ Temp.)$

Where: $500 = Lbs./gal. \times Min./hr. \times Spec.\ Heat\ Water$
$Lbs./gal. = 8.33$
$Min./hr. = 60$
$Spec.\ Heat\ Water = 1$

3. Sensible Btuh

$Sensible\ Btuh = 1.08 \times cfm \times (Ent.\ Air\ DB - Lvg.\ Air\ DB)$

Where: $1.08 = (Sp.\ Ht.\ of\ Air\ at\ 70°F) \times Min./hr. \times Density\ Std.\ Air$
$Sp.\ Ht.\ of\ Air = 0.24\ at\ 70°F$
$Min./hr. = 60$
$Density\ Std.\ Air = 0.075\ lbs./cu.ft.$

4. Face Area: $F.A. = \frac{cfm}{Face\ Velocity\ (fpm)}$

5. Face Velocity: $F.V. = \frac{cfm}{Face\ Area\ (sq.ft.)}$

6. Sensible Heat Ratio: $S.H.R. = \frac{Sensible\ Btuh}{Total\ Btuh}$

Component air friction

Table 5. Component Air Friction

UNIT SIZE	CFM	FILTERS											DAMPERS			VERT. UNIT CASING ②
		FLAT				ANGULAR			HEAVY-DUTY				Mixing Box	Face & Bypass ①	Zone	
		2" T.A.	4" Pleated	Hi Vel/ Clean.	30% Eff.	2" T.A.	Hi Vel/ Clean.	30% Eff.	2" T.A.	Hi Vel/ Clean.	30% Eff.					
103	800	.04	.07	.04	.08	.02	.03	.06	—	—	—		.01	.02	—	.05
	1000	.06	.09	.05	.11	.04	.04	.07	—	—	—		.02	.03	—	.10
	1200	.09	.11	.06	.15	.05	.05	.10	—	—	—		.02	.04	—	.17
	1400	.12	.13	.07	.18	.07	.06	.13	—	—	—		.03	.05	—	.25
	1600	.15	.16	.08	.21	.10	.07	.15	—	—	—		.04	.07	—	.31
	1800	.19	.19	.11	.25	.12	.08	.18	—	—	—		.05	.08	—	—
	2000	—	.21	.13	.29	.15	.09	.21	—	—	—		.06	.10	—	—
104	1000	.04	.07	.04	.07	.01	.02	.06	—	—	—		.01	.02	—	.06
	1200	.05	.09	.05	.10	.02	.03	.06	—	—	—		.02	.02	—	.10
	1400	.07	.10	.06	.13	.03	.03	.07	—	—	—		.02	.03	—	.16
	1800	.12	.13	.08	.18	.05	.04	.09	—	—	—		.03	.05	—	.28
	2200	.18	.17	.09	.23	.07	.05	.12*	—	—	—		.05	.06	—	.35
	2600	—	.22	.13	.29	.10	.06	.15	—	—	—		.06	.09	—	.41
	3000	—	.28	.19	.37	.14	.08	.19	—	—	—		.08	.11	—	—
106	2000	.07	.09	.05	.11	.02	.03	.07	—	—	—		.02	.03	.04	.35
	2500	.11	.12	.06	.16	.04	.04	.08	—	—	—		.04	.05	.06	.43
	3000	.15	.16	.08	.21	.06	.05	.11	—	—	—		.05	.06	.09	.63
	3500	.21	.19	.11	.26	.08	.05	.14	—	—	—		.07	.08	.16	.85
	4000	—	.23	.15	.31	.11	.06	.16	—	—	—		.08	.10	.16	1.11
	4500	—	.28	.19	.37	.14	.08	.19	—	—	—		.11	.13	—	—
	5000	—	.35	.23	—	.17	.09	.22	—	—	—		.13	.16	—	—
206	1800	.06	.09	.04	.10	.02	.03	.06	—	—	—		.01	.02	—	—
	2000	.07	.10	.05	.12	.02	.03	.07	—	—	—		.01	.03	—	—
	2200	.09	.11	.06	.14	.03	.04	.07	—	—	—		.01	.03	—	—
	3000	.15	.16	.08	.21	.06	.05	.11	—	—	—		.02	.05	—	—
	3800	—	.21	.13	.29	.10	.07	.15	—	—	—		.04	.08	—	—
	4600	—	.30	.20	.39	.14	.08	.20	—	—	—		.05	.11	—	—
	5400	—	—	—	—	.19	.10	.25	—	—	—		.07	.16	—	—
108	2200	.06	.09	.04	.11	.02	.03	.06	—	—	—		.01	.02	.02	.05
	2600	.08	.11	.06	.14	.03	.03	.07	—	—	—		.03	.03	.03	.08
	3400	.14	.14	.08	.19	.05	.04	.09	—	—	—		.03	.05	.06	.15
	3800	.17	.17	.10	.22	.06	.05	.11	—	—	—		.04	.06	.07	.22
	4600	—	.22	.12	.29	.09	.06	.14	—	—	—		.06	.08	.11	.31
	5400	—	.29	.19	.38	.16	.09	.18	—	—	—		.08	.11	.15	.36
	7000	—	—	—	—	.21	.11	.26	—	—	—		.13	.18	—	—
209	2600	.06	.09	.05	.11	.03	.03	.07	.01	.02	.04		.01	.02	—	—
	3000	.09	.11	.06	.14	.04	.04	.08	.02	.03	.05		.02	.03	—	—
	3400	.11	.13	.07	.17	.05	.04	.09	.02	.03	.06		.02	.04	—	—
	4200	.17	.17	.09	.22	.07	.06	.11	.04	.04	.08		.03	.05	—	—
	5000	—	.21	.13	.28	.11	.06	.15	.06	.04	.11		.04	.07	—	—
	6200	—	.31	.20	.40	.16	.09	.20	.09	.06	.15		.06	.10	—	—
	7600	—	—	—	—	—	.12	.26	.14	.08	.20		.10	.16	—	—
111	3000	.06	.09	.05	.11	.02	.03	.07	.01	.02	.04		.02	.02	.02	.05
	3500	.08	.11	.05	.14	.03	.04	.08	.02	.03	.05		.02	.03	.03	.08
	4000	.11	.12	.06	.16	.04	.04	.09	.03	.03	.07		.03	.04	.05	.11
	5000	.16	.17	.09	.22	.07	.05	.12	.05	.04	.09		.04	.06	.08	.21
	6000	—	.21	.13	.28	.10	.07	.15	.07	.05	.12		.06	.08	.09	.30
	8000	—	.35	.19	—	.17	.09	.22	.12	.08	.18		.10	.13	.21	.40
	10000	—	—	—	—	—	.15	.31	.19	.10	.24		.16	.21	—	—
114	4000	.07	.09	.05	.12	.03	.03	.07	.02	.03	.05		.02	.02	.02	.06
	4500	.09	.11	.06	.14	.04	.04	.08	.02	.03	.06		.02	.03	.03	.08
	5000	.11	.12	.06	.16	.05	.04	.09	.03	.03	.07		.02	.04	.04	.11
	7000	.21	.19	.11	.25	.09	.06	.15	.06	.04	.11		.04	.07	.08	.26
	9000	—	.29	.19	.37	.15	.09	.21	.10	.07	.15		.07	.11	.14	.36
	11000	—	—	—	—	—	.12	.28	.14	.08	.20		.10	.16	—	—
	13000	—	—	—	—	—	.17	.36	—	.11	.26		.14	.22	—	—

① Pressure drop through face damper 100% open to coil. Bypass duct pressure drop is equivalent of 4-row 10 fpi coil with a "C" wetness.
② Cabinet losses on the horizontal draw-through units and all blow-through units are allowed for in the performance tables.

Table 5. Component Air Friction (Continued)

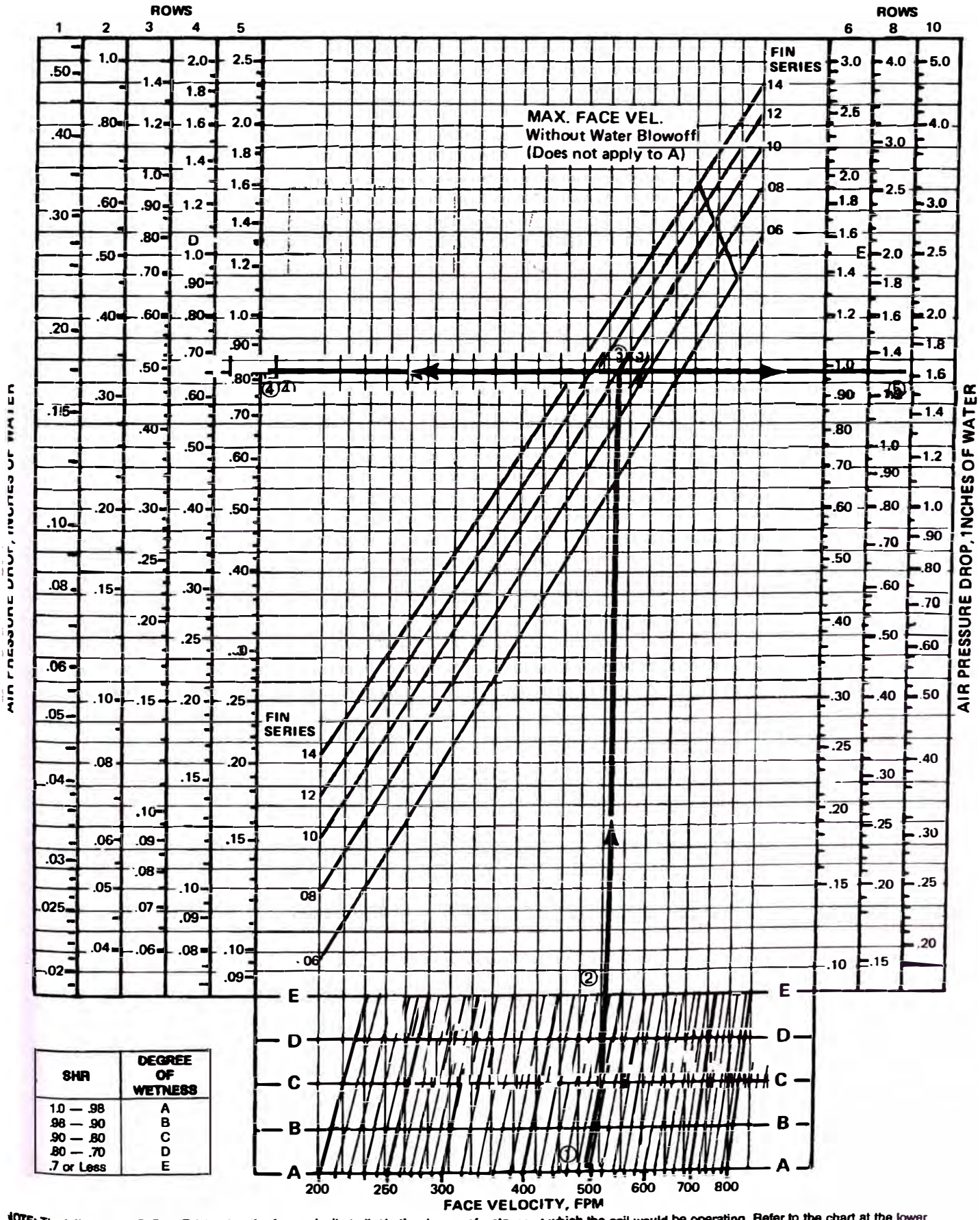
UNIT SIZE	CFM	FILTERS										DAMPERS			VERT. UNIT CASING ②
		FLAT				ANGULAR			HEAVY-DUTY			Mixing Box	Face & Bypass ①	Zone	
		2" T.A.	4" Pleated	Hi Vel/ Clean.	30% Eff.	2" T.A.	Hi Vel/ Clean.	30% Eff.	2" T.A.	Hi Vel/ Clean.	30% Eff.				
117	5000	.07	.10	.06	.13	.04	.04	.08	.02	.03	.06	.02	.03	.03	.07
	6000	.11	.12	.06	.16	.06	.04	.10	.03	.03	.07	.02	.04	.04	.11
	7000	.14	.15	.08	.20	.07	.06	.13	.04	.04	.08	.03	.05	.06	.18
	9000	—	.21	.13	.28	.10	.07	.18	.07	.05	.11	.05	.08	.13	.30
	11000	—	.30	.19	.39	.19	.10	.24	.10	.07	.15	.07	.11	.16	.37
	13000	—	—	—	—	—	.15	.30	.14	.08	.19	.10	.15	—	.42
	15000	—	—	—	—	—	.19	.37	.18	.09	.23	.12	.20	—	—
122	6000	.06	.09	.04	.11	.04	.04	.08	.01	.02	.05	.01	.02	.03	.04
	7000	.08	.11	.05	.14	.05	.05	.10	.02	.03	.06	.02	.03	.04	.05
	8000	.11	.12	.06	.16	.07	.05	.12	.02	.03	.07	.02	.04	.06	.08
	10000	.16	.16	.09	.22	.11	.06	.16	.04	.04	.09	.03	.06	.08	.14
	12000	—	.21	.13	.28	.15	.08	.21	.06	.05	.11	.05	.08	.12	.24
	15000	—	.32	.20	.41	—	.13	.28	.09	.06	.15	.07	.13	.20	.33
	19000	—	—	—	—	—	.21	.41	.14	.08	.20	.11	.20	—	—
128 134	8000	.07	.09	.05	.12	.04	.04	.08	.01	.02	.05	.01	.03	.03	.05
	9000	.09	.11	.06	.14	.06	.04	.10	.02	.03	.06	.02	.03	.04	.06
	10000	.11	.12	.06	.16	.11	.05	.12	.02	.03	.07	.02	.04	.05	.08
	13000	.18	.17	.09	.23	.17	.07	.17	.05	.04	.09	.03	.06	.08	.17
	17000	—	.26	.16	.34	.19	.11	.25	.07	.06	.13	.06	.10	.14	.30
	21000	—	.36	—	—	—	.16	.33	.11	.07	.17	.08	.16	—	.38
	25000	—	—	—	—	—	.23	—	.17	.09	.22	.12	.22	—	—
137	10000	.07	.09	.05	.12	.04	.04	.08	.01	.02	.06	.02	.02	.03	.02
	12000	.10	.11	.06	.15	.06	.04	.10	.02	.03	.07	.02	.03	.04	.03
	14000	.14	.14	.08	.19	.07	.06	.13	.03	.04	.08	.02	.04	.06	.05
	18000	.22	.20	.12	.26	.12	.07	.18	.06	.04	.10	.04	.07	.09	.09
	22000	—	.28	.18	.36	.19	.10	.24	.08	.05	.14	.05	.10	.14	.17
	28000	—	.36	—	—	—	.15	.35	.11	.07	.17	.07	.13	.21	.25
	32000	—	—	—	—	—	.22	—	.17	.09	.23	.11	.20	—	—
141	12000	.07	.09	.05	.12	.04	.04	.08	.01	.02	.05	.01	.03	.04	.02
	14000	.09	.11	.06	.15	.05	.05	.10	.02	.03	.06	.02	.04	.06	.03
	16000	.12	.13	.07	.18	.07	.05	.12	.03	.03	.07	.02	.04	.07	.05
	20000	.19	.18	.10	.24	.11	.06	.16	.05	.04	.09	.03	.06	.12	.08
	24000	—	.24	.15	.31	.15	.08	.21	.07	.05	.12	.04	.09	.17	.13
	28000	—	.32	.20	.41	.21	.11	.26	.09	.06	.15	.06	.12	.25	.19
	38000	—	—	—	—	—	.19	.38	.15	.08	.21	.09	.20	—	—
150	15000	.08	.10	.05	.13	.04	.04	.08	.01	.02	.05	.02	.03	.04	.03
	18000	.11	.12	.07	.16	.06	.04	.10	.02	.03	.06	.02	.04	.06	.04
	21000	.15	.16	.08	.21	.07	.06	.13	.03	.04	.07	.03	.05	.09	.05
	27000	—	.22	.13	.29	.12	.07	.18	.06	.04	.10	.05	.08	.15	.10
	33000	—	.32	.20	.41	.19	.10	.24	.08	.05	.14	.08	.12	.23	.18
	39000	—	—	—	—	—	.14	.30	.11	.07	.17	.11	.17	—	.26
	45000	—	—	—	—	—	.19	.38	.15	.08	.21	.14	.22	—	—
164	18000	.07	.10	.06	.13	.03	.04	.08	.02	.03	.06	.02	.03	.04	—
	20000	.09	.11	.06	.15	.04	.04	.09	.03	.03	.07	.02	.03	.06	—
	24000	.14	.14	.08	.19	.06	.05	.11	.04	.04	.09	.03	.03	.08	—
	32000	—	.21	.13	.28	.11	.07	.17	.08	.05	.13	.05	.07	.15	—
	40000	—	.32	.21	.41	.18	.09	.23	.12	.07	.18	.08	.11	.25	—
	48000	—	—	—	—	—	.13	.29	.18	.09	.23	.11	.15	—	—
	56000	—	—	—	—	—	.19	.37	—	.13	.28	.15	.21	—	—
172	28000	.14	.15	.08	.20	.08	.05	.14	.06	.04	.11	.04	.05	.11	—
	16000	.16	.16	.09	.22	.10	.06	.15	.07	.05	.12	.05	.06	.13	—
	32000	.19	.18	.10	.24	.11	.06	.17	.08	.05	.13	.05	.06	.16	—
	36000	—	.21	.13	.28	.14	.08	.20	.10	.06	.15	.06	.17	.19	—
	40000	—	.25	.16	.33	.18	.09	.23	.13	.07	.18	.08	.09	.25	—
	44000	—	.30	.19	.39	.22	.11	.26	.15	.08	.20	.09	.11	.32	—
	50000	—	.36	—	—	—	.14	.31	.20	.10	.24	.12	.14	.44	—

① Pressure drop through face damper 100% open to coil. Bypass duct pressure drop is equivalent of 4-row 10 fpi coil with a "C" wetness.
② Cabinet losses on the horizontal draw-through units and blow-through units are allowed for in the fan performance tables.

See Page 36 For MSL-190 Air Friction

Coil air pressure drop

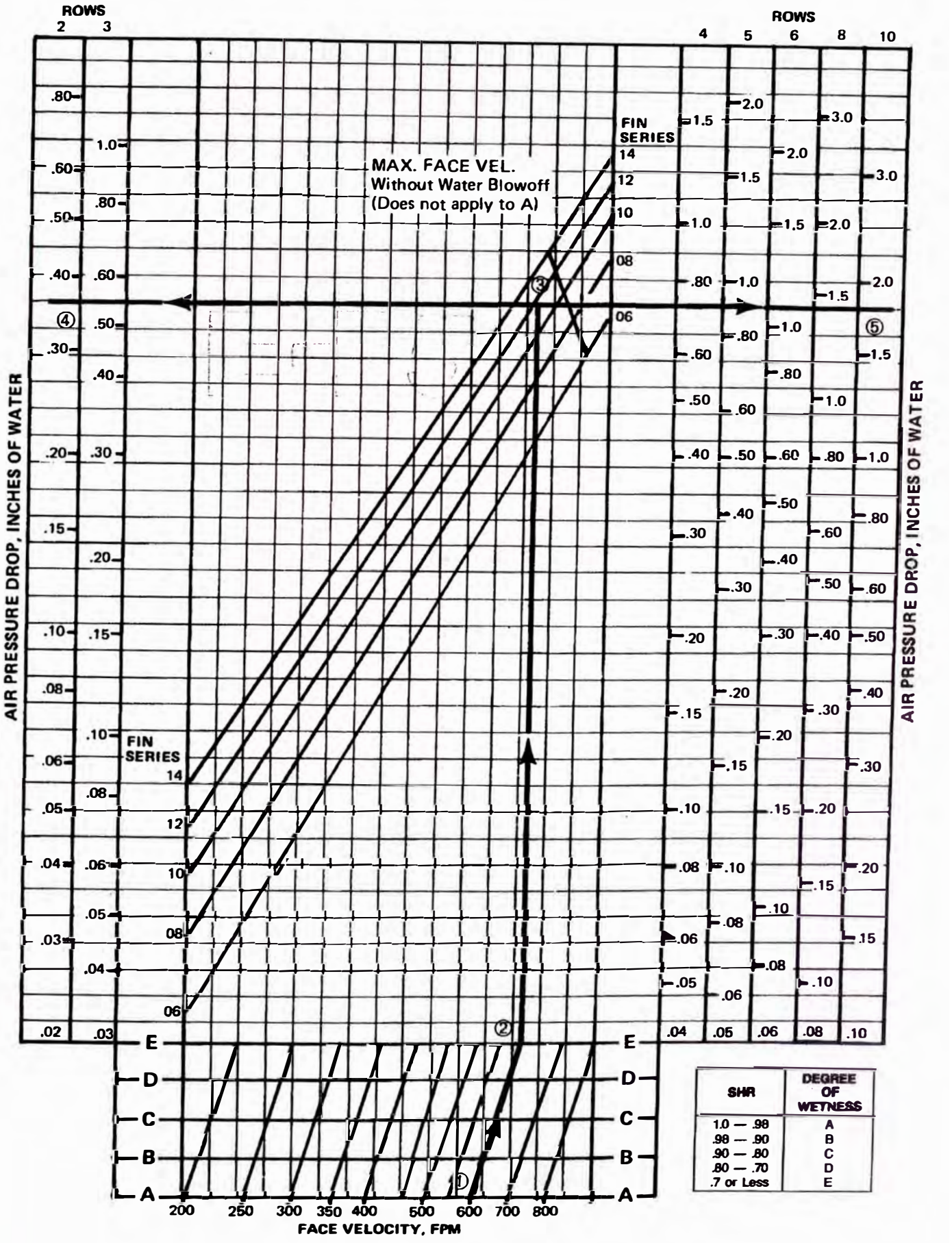
Figure 2. HI-F5 Air Pressure Drop



SHR	DEGREE OF WETNESS
1.0 — .98	A
.98 — .90	B
.90 — .80	C
.80 — .70	D
.7 or Less	E

NOTE: The letters A, B, C, D or E following the face velocity indicate the degree of wetness at which the coil would be operating. Refer to the chart at the lower left-hand corner for the appropriate degree of wetness.

Figure 3. E-F5 Air Pressure Drop (2 Thru 10 Rows)



NOTE: The letters A, B, C, D or E following the face velocity indicate the degree of wetness at which the coil would be operating. Refer to the chart at the lower right-hand corner for the appropriate degree of wetness.

Figure 4. E-F5 Air Pressure Drop (1-Row)

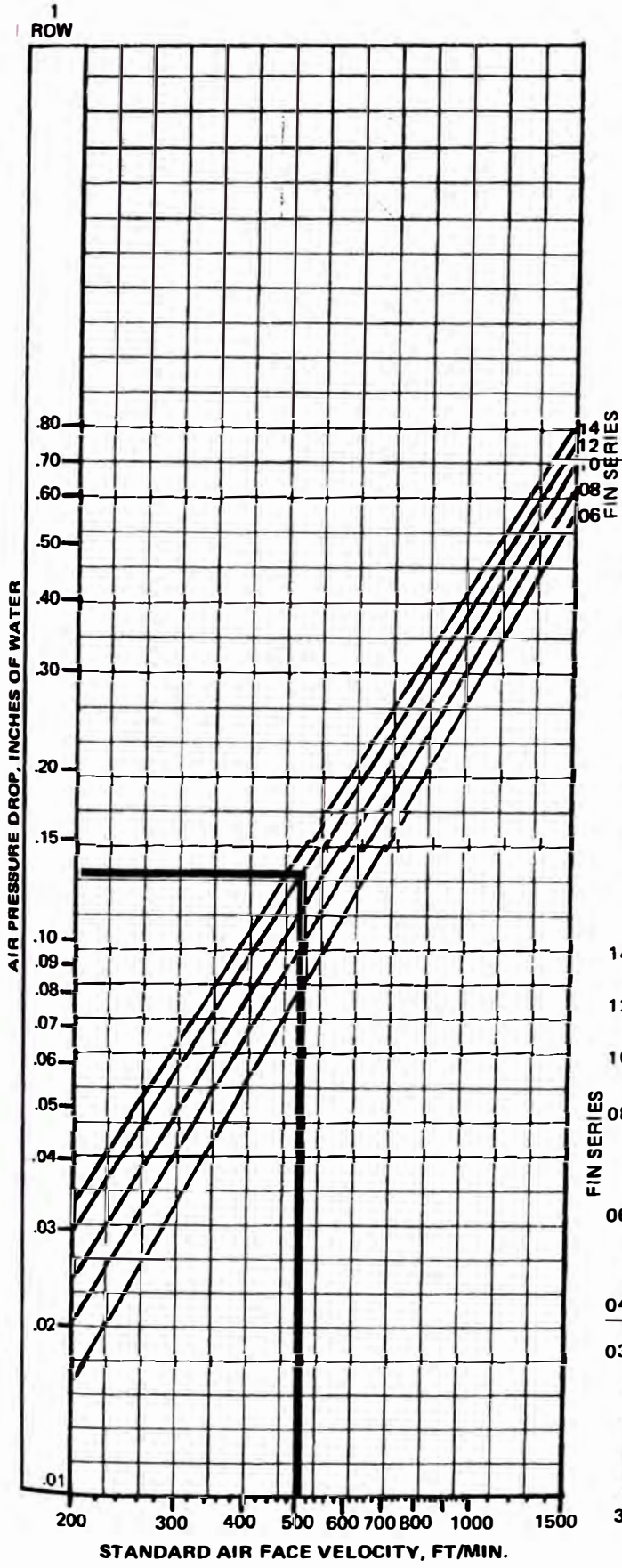
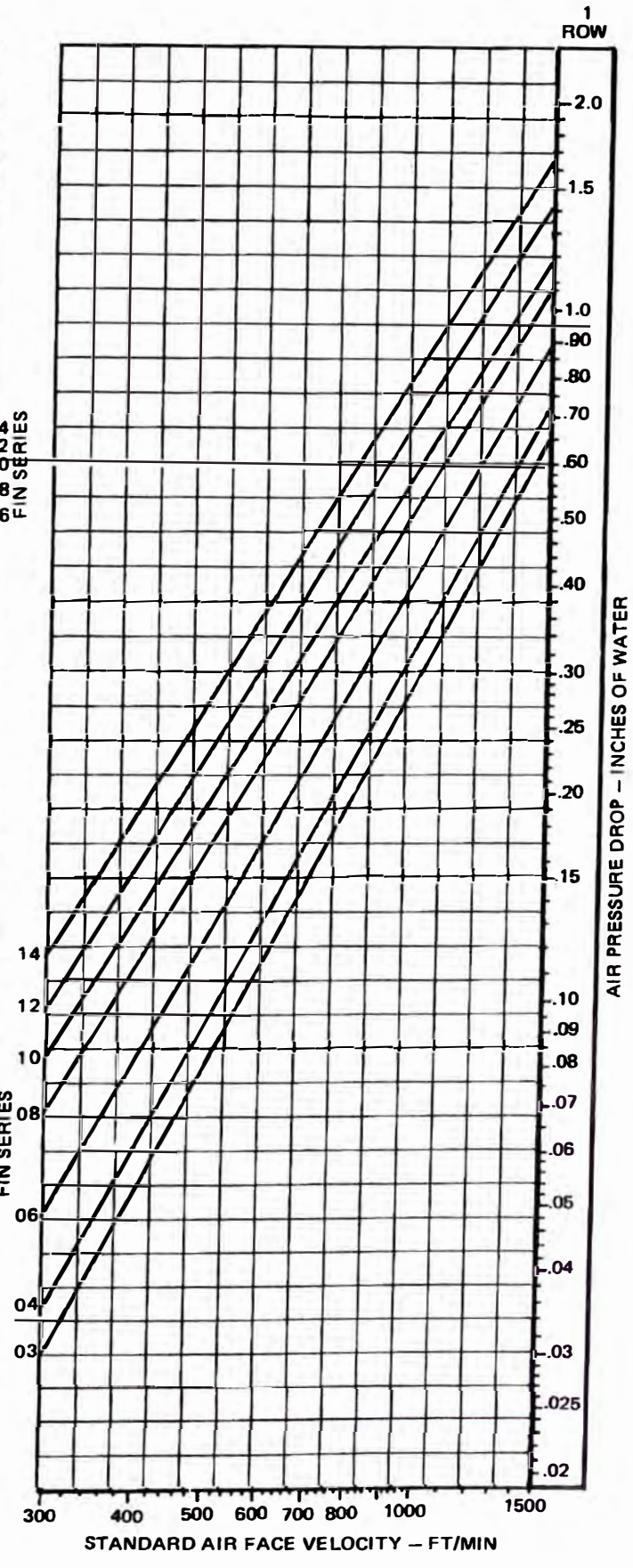


Figure 5. HI-F8 Air Pressure Drop (1″ Steam)



Discharge arrangements

Fan discharge arrangements, air intakes and motor locations

It is imperative that everyone designate the fan discharge arrangement, coil connection location, etc., with the same view of the unit. McQuay designations for fan rotation, motor location and air discharge arrangements are determined by looking at the drive end of the unit. Table 6 gives a complete listing of the fan rotation and fan discharge arrangements available. Having established the proper view of the unit for reference purposes, the coil connection locations, damper extensions, etc., are designated as drive end or opposite drive end.

Table 6. Fan Discharge & Rotation Arrangements

DESIGNATION	FAN ROTATION	FAN DISCHARGE
1	Clockwise	Top Horizontal
2	Counterclockwise	Top Horizontal
3	Clockwise	Bottom Horizontal
4	Counterclockwise	Bottom Horizontal
5	Clockwise	Upblast
6	Counterclockwise	Upblast
7	Clockwise	Downblast
8	Counterclockwise	Downblast

Figure 6. Blow-through LSB, MSB, LML & MMM Units

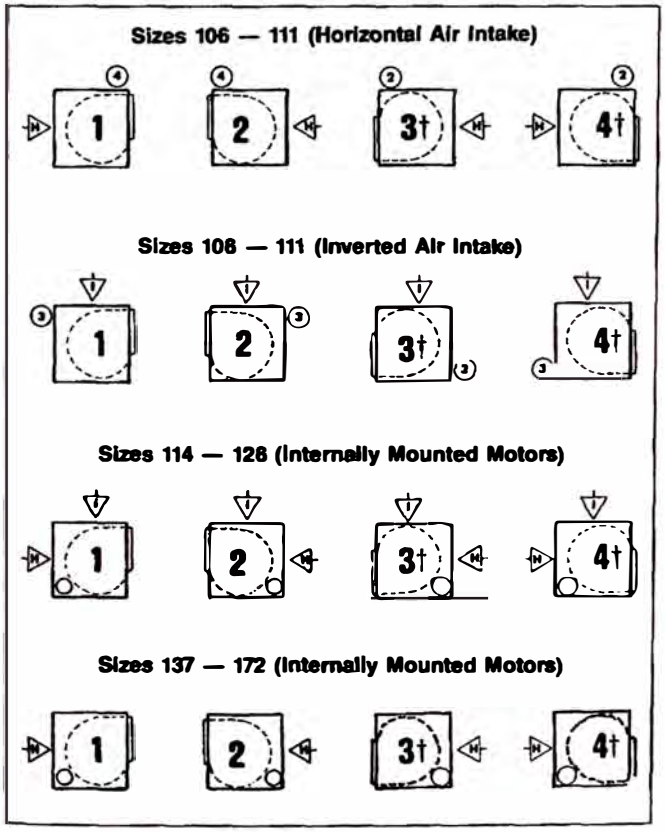
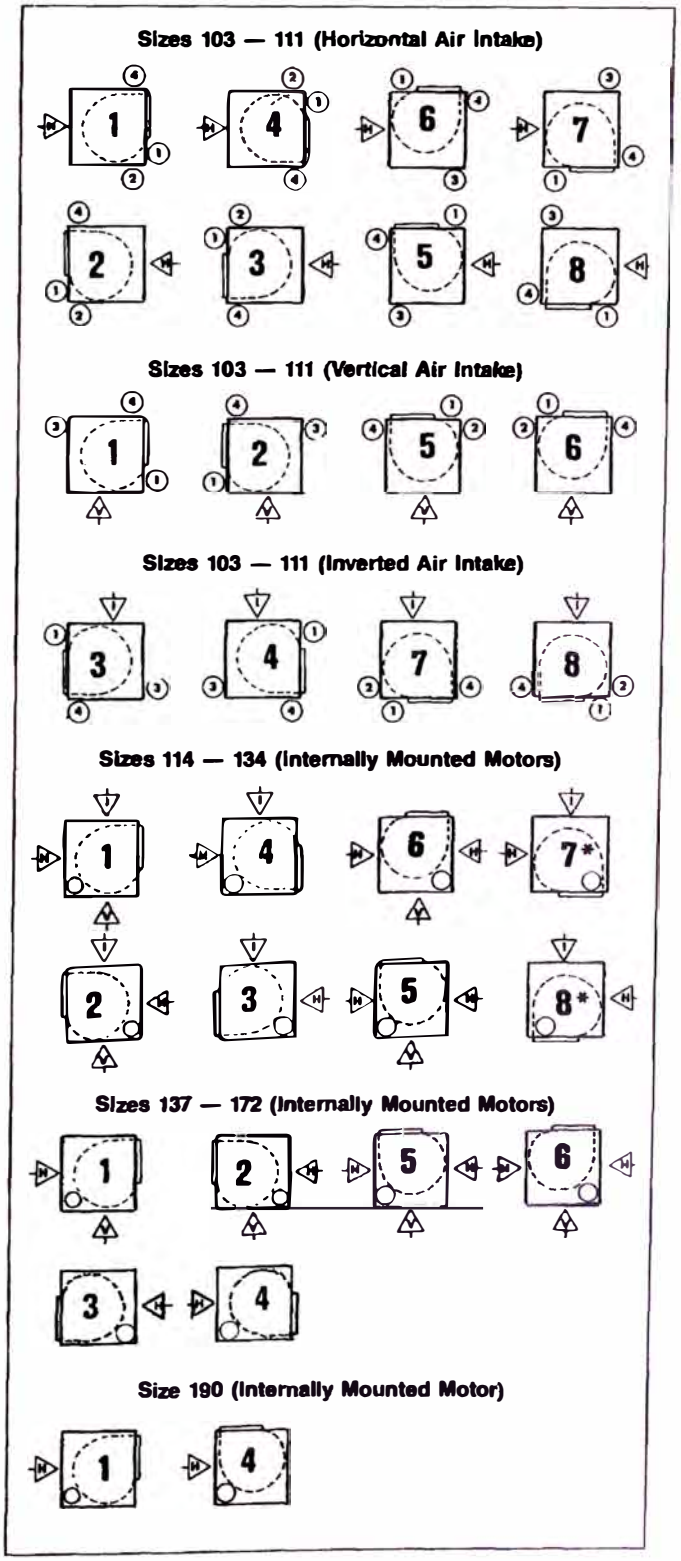


Figure 7. LSL, MSL, LHD & LYF Units

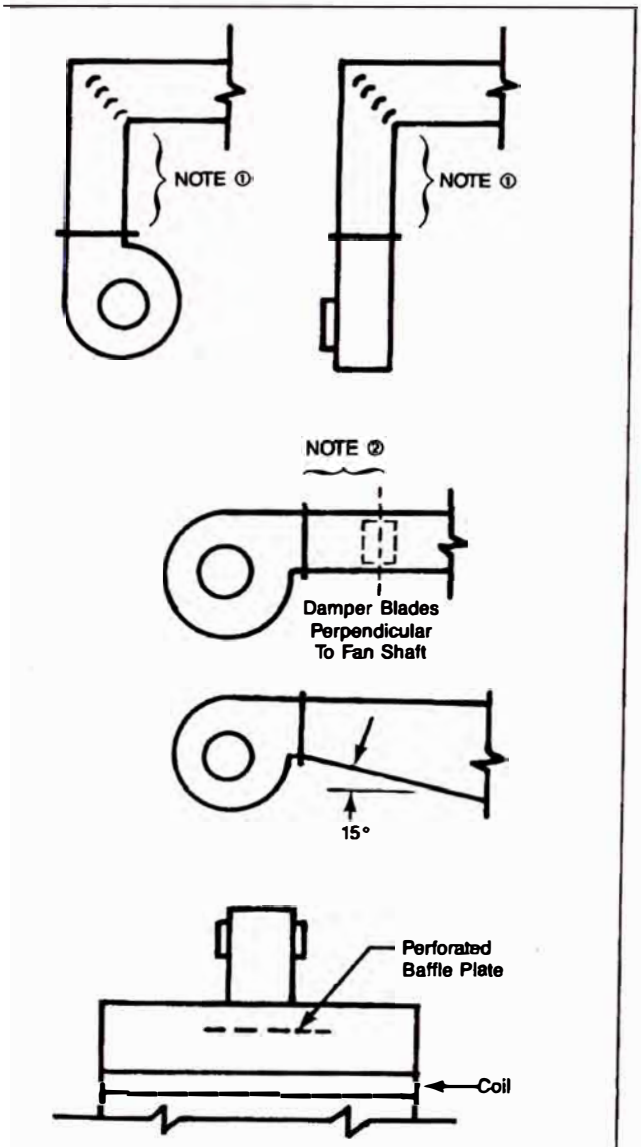


NOTES: 1. ① ② ③ and ④ Indicate available motor locations. Motor and external face and bypass cannot be located on same panel.
2. *Internal isolation not available with downblast discharge.
3. †Bottom horizontal discharge not available for LML and MMM units.

All units viewed from drive end

Application considerations

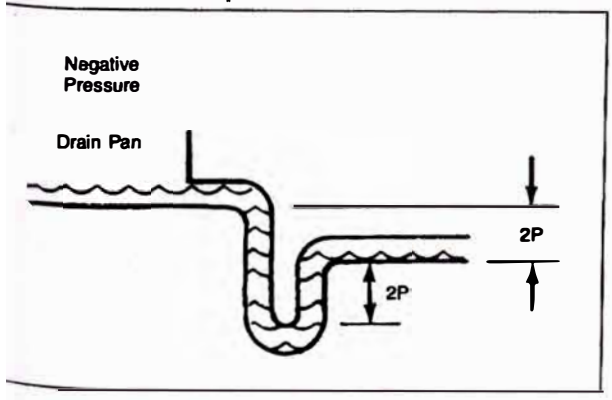
igure 8. Discharge Duct Layout



NOTES: ① Elbows should not be closer than 1½ to 2½ times the largest dimension of fan discharge opening.
② Dampers should be placed at least 3 fan diameters downstream of the fan discharge.

FIGURES REPRINTED WITH PERMISSION FROM THE 1979 ASHRAE GUIDE AND DATA BOOK (EQUIPMENT).

gure 9. Drain Pan Traps



Installation flexibility

McQuay central station air handlers feature sectionalized design to provide maximum installation flexibility. Fan, coil, filter, mixing box, face and bypass, and access sections allow the design flexibility of built-up systems with the cost advantage of factory fabricated units. Every section is fabricated of heavy-gauge continuous galvanized steel with exacting assembly procedures and rigid quality control standards.

Mounting and access

Whether units are floor or ceiling mounted, care should be taken to insure that the supporting structure is level and rigid enough for satisfactory unit operation. Ideally, a heavy concrete slab should be used for bottom mounted units, and main support beams for top hung units. Long floor or ceiling spans should be avoided.

Units should be located so as to provide proper access for routine service. Clearance for filter removal on both sides of the filter section is usually necessary. Clearance should be provided as required for access panels. Room should be allowed for coil removal. Cooling units require clearance for a trap in the drain pan line.

Access to the interior of McQuay air handlers is provided by hinged access doors or removable panels wherever possible. Hinged access door kits are also available for field installation. For access between components, a versatile access section features hinged access doors at both ends.

Ductwork

Good ductwork layout will minimize system resistance and sound generation. Duct connections to and from units should allow straight, smooth airflow. Sharp turns in the fan discharge should be avoided, particularly turns opposed to wheel rotation. Turning vanes should be used. Discharge plenums or any abrupt change in duct size should be avoided. When a factory fan section is to be matched with a field fabricated coil bank in a blow-through configuration, a diffuser plate should be located so as to distribute the airflow as evenly as possible across the coil face area. See Figure 8 for good fan outlet practices.

Piping and drain pan traps

Piping should be in accordance with accepted industry standards. Undue stress should not be applied at the connection to coil headers. Pipe work should be supported independently of the coils with adequate piping flexibility for thermal expansion. Drain lines and traps should be run full size from the drain pan connection. Drain pans should have traps to permit the condensate from the coils to drain freely. On a draw-through unit, the trap depth and the distance between the trap outlet and the drain pan outlet should be twice the negative static pressure under normal unit operation.

Vibration isolation

To insure that noise and vibration are compatible with the intended use of the conditioned air space, good acoustical and vibration engineering practices should be applied during the early stages of design.

While most applications require vibration isolation, McQuay central station air handlers are available with factory installed internal isolation for most unit sizes and field installed externally mounted isolators for all unit sizes. Internally isolated units feature internally mounted 2″ deflection spring isolators sized specifically for each fan wheel and unit size. Internally isolated units are thrust restrained for smooth startup. Because internal isolation minimizes vibration at the source (fan and motor), there is seldom a need for flexible connections on ductwork or coil piping. Internal isolation provides an opportunity for significantly reduced installation costs.

Blow-through air handler applications

Blow-through SeasonMaster central station air handlers are available in singlezone, two-deck and three-deck configurations. Singlezone units are offered with cooling coil sections or with diffuser sections only. The two- and three-deck units are offered with or without zone dampers. All unit configurations include a perforated plate fan discharge diffuser to provide even airflow downstream of the fan.

Multizone and dual duct air handlers typically provide comfort conditioning by distributing a constant air volume at variable temperature. In a typical system a portion of the air is heated by passing through the heating coil and the balance is cooled by the cooling coil. The heated and cooled airstreams are then mixed in the required proportion to provide the optimum temperature air to the conditioned space.

For dual duct applications, a pair of ducts bring heated and cooled air to the air mixing terminal boxes where the airstreams are mixed. By adding zone dampers to the dual duct unit, the air mixing takes place at the unit discharge and only one duct is required to distribute conditioned air to the building. The air mixing terminal boxes are also eliminated.

By adding a third bypass deck to the hot and cold decks, a triple deck multizone is created. The triple deck configuration offers significant energy conservation opportunities by allowing return or outside air to bypass both coils. The thermal inefficiency of mixing heated and cooled air is eliminated by the addition of the bypass deck. Bypass air is mixed with heated air for building zones that require heating. Bypass air is mixed with cooled air for building zones that require cooling.

Multizone air handling systems result in an absence of water, steam and condensate drain piping, wiring, electrical and mechanical equipment in the conditioned space . . . for more usable commercial floor area and higher rental income.

Air handler insulation

Air handler cabinet insulation requirements are dependent on moisture and noise control concerns. Insulation greatly reduces the possibility of cabinet sweating for cooling applications in humid climates. Cabinet insulation also contributes significantly to unit sound attenuation.

All air handler sections can be provided with 1" thick neoprene coated fiber insulation in ¾ lb., 1½ lb., and 3 lb. densities. Cooling coil sections are always provided with ¾ lb. density insulation as a standard or can be provided with optional 1½ lb. or 3 lb. insulation density.

In addition to providing insulation, most sections can be provided with galvanized sheet metal liners. The liner option is available with 1" thick insulation in multizone blow-through coil sections and 2" thick, 1½ lb. density insulation for fan sections, singlezone cooling coil sections, and most accessory sections.

Air supply systems and fan laws

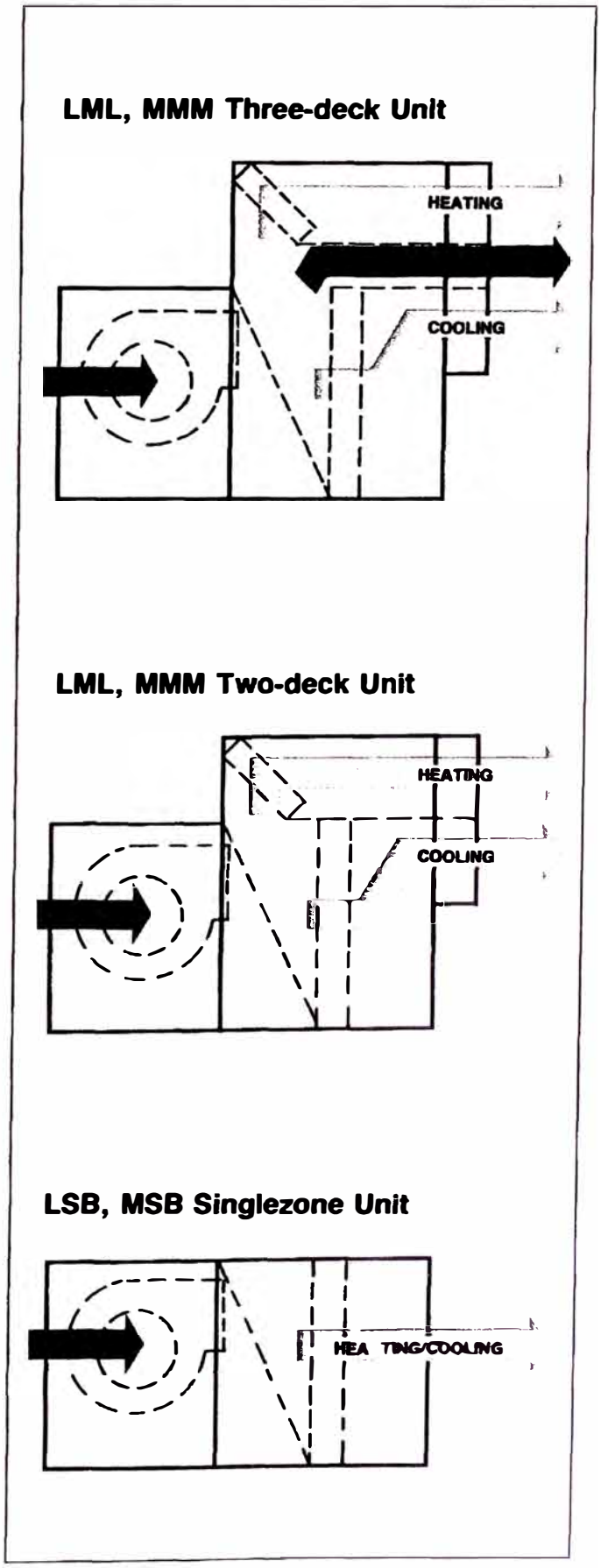
An air supply system consists of an air handler cabinet, heat exchanger, filters, ductwork, grilles and registers used to distribute air throughout the building. The system is independent of the fan used to supply the system.

The resistance of the system, referred to as static pressure (SP), is dependent upon the quantity of air (cfm) that is moved through it. The air quantity is determined by the cooling, heating and ventilating requirements.

For any system, the static pressure will vary directly as the square of the air quantity. This relationship between cfm and SP establishes the system curve for that system and may be expressed as follows:

$$\left(\frac{cfm_1}{cfm_2}\right)^2 = \frac{SP_1}{SP_2} \quad \text{or} \quad SP_2 = SP_1 \left(\frac{cfm_2}{cfm_1}\right)^2$$

Figure 10. Blow-through Air Handler Configurations



The system curve is unique for a particular system configuraton. Any change to the system caused by dirty filters, damper changes, etc., will result in a new system curve.

For fans operating at low pressures (less than 10" W.G.), the effects of air compression are negligible. Disregarding air compression allows fan operation in a fixed system to be expressed by simple relationships. These relationships are know as fan laws and may be used to calculate the effects of fan speed and air density changes on this system.

1. The flow rate varies directly with the change in fan speed:

$$\frac{cfm_1}{cfm_2} = \frac{rpm_1}{rpm_2} \quad \text{or} \quad cfm_2 = cfm_1\left(\frac{rpm_2}{rpm_1}\right)$$

A 10% increase in fan speed will give a 10% increase in air quantity.

2. The static pressure varies as the square of the change in fan speed:

$$\frac{SP_1}{SP_2} = \left(\frac{rpm_1}{rpm_2}\right)^2 \quad \text{or} \quad SP_2 = SP_1\left(\frac{rpm_2}{rpm_1}\right)^2$$

A 10% increase in fan speed will give a 21% increase in static pressure.

3. The fan brake horsepower varies as the cube of the change in fan speed:

$$\frac{hp_1}{hp_2} = \left(\frac{rpm_1}{rpm_2}\right)^3 \quad \text{or} \quad hp_2 = hp_1\left(\frac{rpm_2}{rpm_1}\right)^3$$

A 10% increase in fan speed will give 33% increase in fan horsepower.

4. System static pressure and brake horsepower are directly proportional to the air density:

$$SP_2 = SP_1\left(\frac{Density_2}{Density_1}\right)\left(\frac{rpm_2}{rpm_1}\right)^2$$

$$hp_2 = hp_1\left(\frac{Density_2}{Density_1}\right)\left(\frac{rpm_2}{rpm_1}\right)^3$$

Consequently, the static pressure and brake horsepower decrease with an increase in air temperature or higher altitude, and increase with a decrease in air temperature or lower altitude.

To determine fan performance for temperatures and altitudes other than standard (70°F, 0 ft. altitude), the static pressure must be adjusted by the density ratio before the fan rpm and bhp requirements can be determined. Density ratios are expressed as temperature and altitude conversion factors in Table 7.

Table 7. Temperature and altitude conversion factors

AIR TEMP. (°F)	ALTITUDE (FEET)								
	0	1000	2000	3000	4000	5000	6000	7000	8000
-20	1.20	1.16	1.12	1.08	1.04	1.00	.97	.93	.89
0	1.15	1.10	1.08	1.02	.99	.95	.92	.88	.85
20	1.11	1.06	1.02	.98	.95	.92	.88	.85	.82
40	1.06	1.02	.98	.94	.91	.88	.84	.81	.78
60	1.02	.98	.94	.91	.88	.85	.81	.79	.76
70	1.00	.96	.93	.89	.86	.83	.80	.77	.74
80	.98	.94	.91	.88	.84	.81	.78	.75	.72
100	.94	.91	.88	.84	.81	.78	.75	.72	.70
120	.92	.88	.85	.81	.78	.76	.72	.70	.67
140	.89	.85	.82	.79	.76	.73	.70	.68	.65
160	.85	.82	.79	.76	.74	.70	.68	.65	.63
200	.80	.77	.75	.72	.69	.67	.64	.82	.60
250	.75	.72	.69	.67	.65	.62	.60	.58	.56

Fan and motor heat

Motor and drive heat — The total energy input to any fan motor is always eventually converted into heat. The input energy is consumed in two ways — by heat dissipated through the motor frame and by work output. The amount of heat dissipated by the motor is a function of its operating efficiency:

$$Motor\ Heat = Input \times (1 - Motor\ Efficiency)$$

A small amount of the motor work output is dissipated by the drive mechanism, which also results in a heat gain. Belt drive losses are a function of belt tension and number of belts as well as power transmitted. Typical belt drive losses range from 2% to 6% of bhp.

Whether motor and drive heat gain become part of an air handling system cooling load depends on the motor location relative to the conditioned space. For air handlers with internal motors, the motor and drive are within the conditioned space. Therefore, the motor and drive add heat to the system. This heat must be subtracted from the cooling capacity and added to the heating capacity of the unit.

For units with external motors located in an equipment room, the motor and drive heat are part of the equipment room heat gain. For equipment rooms vented to the outside (and also for roof mounted units), heat generated by an external motor and drive need not be considered.

Fan heat generation — All of the power input to a fan results in heat gain which must be considered as a cooling load. The amount of heat generated is directly proportional to the fan bhp:

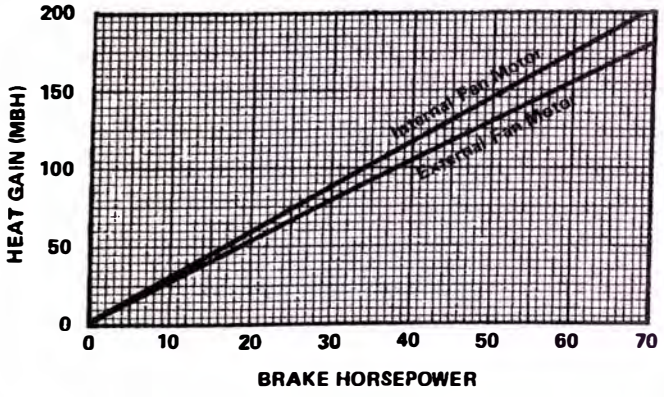
$$Fan\ Heat\ (Btuh) = bhp \times 2545$$

Much of this heat generation occurs within the fan itself. Fans are far from 100% efficient, and the energy losses which occur are converted directly into heat. The work done by the fan on the airstream increases the temperature, pressure and velocity of air. The heat of compression required to raise the airstream to this increased energy level is also a heat gain.

As the air travels throughout the building, its energy is deteriorated by friction, resulting in pressure drop. This is also heat gain, but it does not result in a temperature rise because the air expands as the pressure is reduced. The expansion is a cooling process which offsets the heat generated by friction.

Typical fan and motor heat values are given in Figure 11. The upper curve expresses fan heat as a function of bhp, and should be used for units with internal motors. This curve should also be used for units with external motors located within the conditioned space.

Figure 11. Fan & Motor Heat Gain



Air handler sound

Sound generation from air handlers must be carefully considered in well engineered systems. In selecting the unit, the engineer should analyze the expected sound power spectrums of unit size and fan wheel options and proceed with an attenuation analysis. The unit placement location, duct silencers, acoustical duct lining and equipment room construction are among the attenuation options available.

Sound power levels can be used as a basis of comparison between air handlers of various manufacturers and between fan wheel options of a specific McQuay air handler unit size. Because an industry standard of air handler sound testing does not presently exist, an equitable means of comparison between manufacturers is the procedure of fan sound power level estimation presented in the 1987 ASRHAE Systems and Applications Handbook.

Sound power levels in decibels for the center frequency of 7 of the 8 octave bands can be estimated with equation 1. The equation is applied to each of the 7 octave bands. The 8th octave band is not included in the ASHRAE method for fan sound power estimation.

$$PWL = (specific\ sound) + (system) + (blade\ frequency) + (point\ of\ operation) - (cabinet\ attenuation) \quad (1)$$

All terms in the equation are expressed in decibels and are defined below:

PWL — Air handler sound power level at the center frequency of each octave band.

Specific Sound — The specific sound power level is dependent on fan wheel type, diameter and octave band. Refer to Table 8 for specific sound power levels.

System — The system decibel level is dependent on fan airflow (cfm) and total static pressure (TSP, inches W.G.). The system level can be calculated from equation 2. Note that the system level is the same for all octave bands.

$$System = 10\ (log\ cfm) + 20\ (log\ TSP) \quad (2)$$

Blade Frequency — Fans generate a pure tone at the blade passage frequency. The resulting sound power can be estimated for forward curved and airfoil fans as follows:

1. For forward curved fan wheel units, add 2 dB to the one octave band which contains the frequency equal to the RPM of the fan.
2. For airfoil fan wheel units, add 3 dB to the one octave band which contains the frequency equal to the fan rpm divided by 5.

NOTE: Blade passage frequency occurs in only one octave band.

Point of Operation — Fan performance at peak efficiency point of operation generally corresponds to the lowest noise level for the fan. If the fan cannot be selected near its peak efficiency, the noise level will increase and a point of operation factor must be included in the sound power estimation for all octave bands. The point of operation factor is included in the MS-85™ Air Handler Selection Program Sound Calculation. The factor varies from 3 dB for a fan operating at 85% of its peak efficiency to 15 dB for a fan operation at 50% of peak efficiency.

Cabinet Attenuation — The cabinet of an air handler significantly reduces the sound radiated from the fan. To estimate radiated sound power for air handler fans, 15 dB should be subtracted from each octave band. Equation 1 without the cabinet attenuation term represents total sound power emanating from the inlet, outlet and fan housing of a bare fan having no cabinet.

Sound power levels of each octave band can be used directly as a comparison between air handlers or they can be used as a basis for determining several other means of air handler sound comparison and sound attenuation analysis. For a more detailed discussion of air handler sound including basic definitions, the A weighted scale, NC curves, variable air volume, and noise attenuation, refer to Air Handler Engineering Data Bulletin 1007.

Table 8. Specific Sound Power Levels By Octave Band

FAN TYPE	WHEEL DIAMETER	OCTAVE BAND NUMBER						
		1	2	3	4	5	6	7
AIRFOIL	36" & Over	32	32	31	29	28	23	15
	Under 36"	36	36	36	34	33	28	20
FORWARD CURVED	All Sizes	47	42	39	33	28	25	23

NOTE: The above values are the specific sound power levels radiated from either the inlet or outlet of the fan. If the total sound power level (including cabinet radiation) is desired, add 3 dB to the above values.

Table reprinted with permission from the 1987 ASHRAE Systems and Applications Handbook.

Air volume modulation

Discharge dampers

The simplest form of fan modulation used today is the practice of riding the fan curve. What this involves is simply allowing a forward curved fan to rise to the left on its constant rpm line in response to an increase in system static pressure. There are two methods of increasing system static pressure. One is simply closing off the variable air volume terminals. The other is through the use of discharge or inlet dampers.

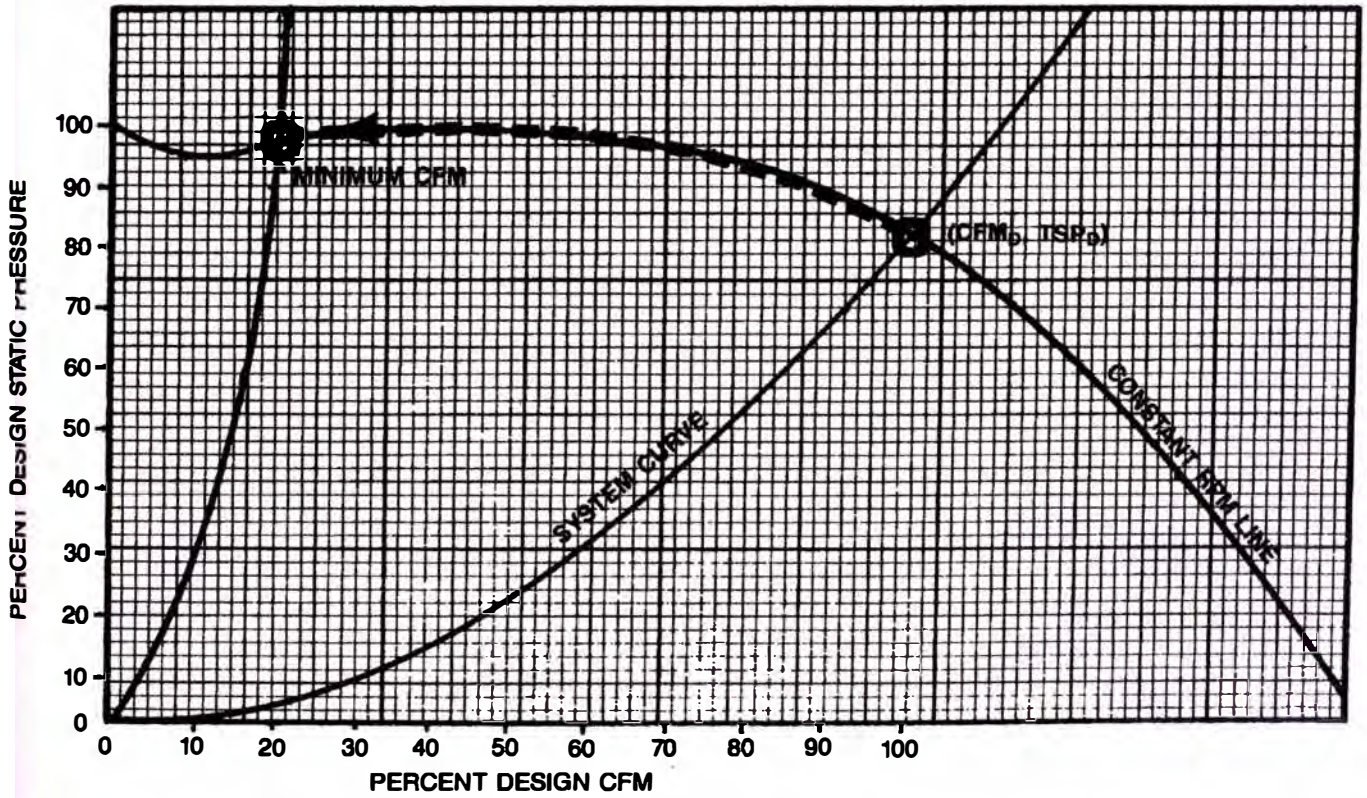
Discharge dampers are preferred to merely closing off variable air volume terminals since they greatly reduce the possibility of overpressurizing the ductwork and eliminate the potential for air velocity noise problems at the space that would occur when the variable air volume terminals begin to close. As the discharge dampers begin to close, more and more pressure drop is seen across the damper. As this static pressure is increased, it causes the operating point of the fan to move upward to the left along the constant rpm line, thus resulting in a reduction in airflow.

Because of the characteristics of a forward curved fan, the brake horsepower is reduced significantly as the fan operating point rides up this rpm curve (Figure 12). By riding the rpm line back to the surge area, the minimum recommended cfm is obtained. Brake horsepower reduction can be read directly off the fan curve for reduced cfm values.

The characteristics of an airfoil fan allow virtually no bhp savings with discharge dampers. Excessive duct pressure will also be encountered. For these reasons, airfoil fans are not typically used with discharge dampers.

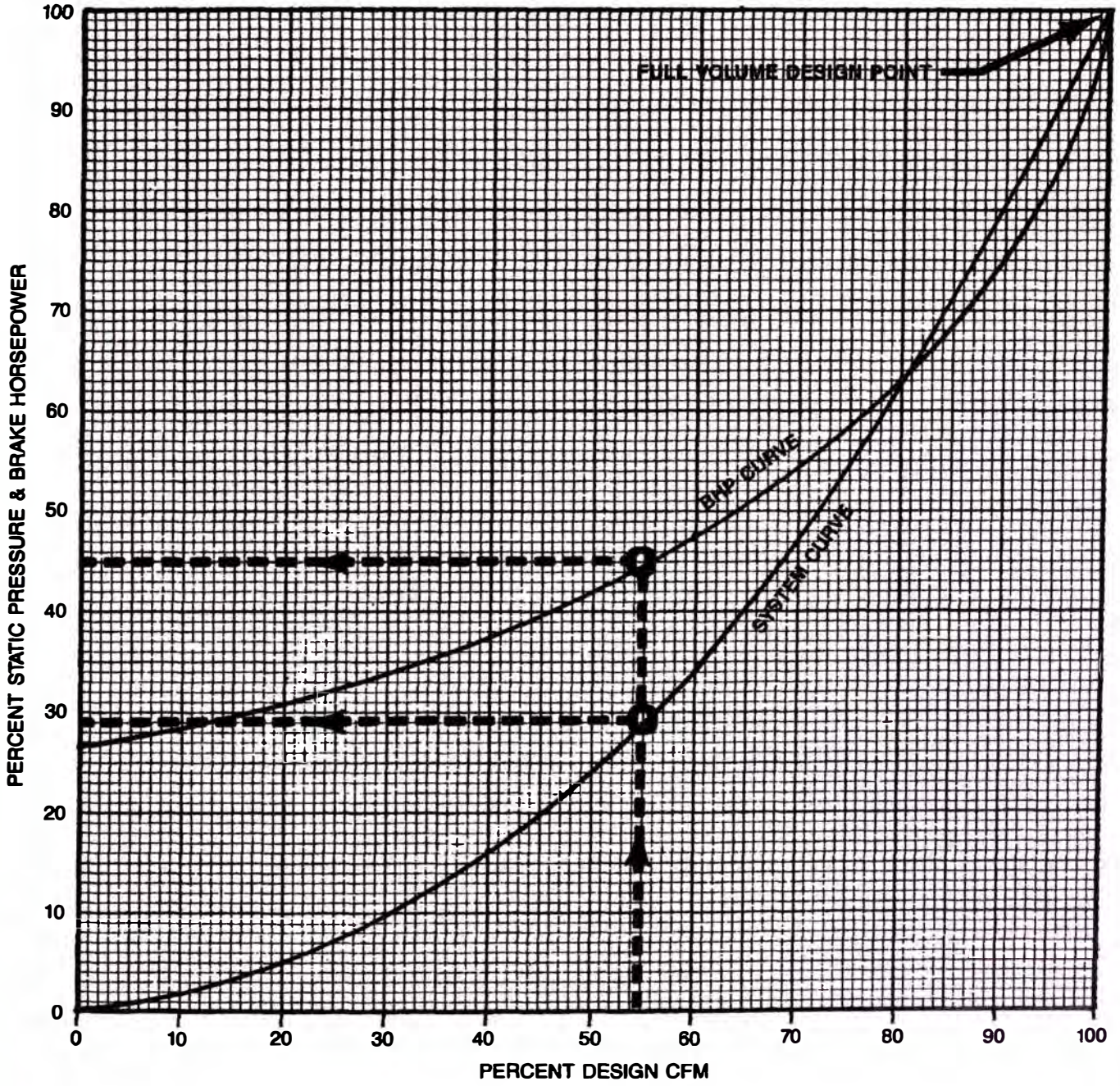
To assure uniform airflow across the discharge damper and to reduce the possibility of excessive noise or vibration, it is recommended that discharge dampers be located at least three fan diameters downstream of the fan outlet. Discharge dampers offer good power savings over a fairly wide modulation range with both low first cost and low maintenance costs.

Figure 12. Discharge Damper Air Volume Modulation



Find design cfm and total static pressure. Follow constant rpm line left to minimum cfm point. Read new bhp and cfm.

Figure 13. Inlet Vane Control Reduction Factors



Follow percent of design cfm up to system curve and left for percent of design static pressure. Follow percent of design cfm up to bhp curve and left for percent of rated horsepower.

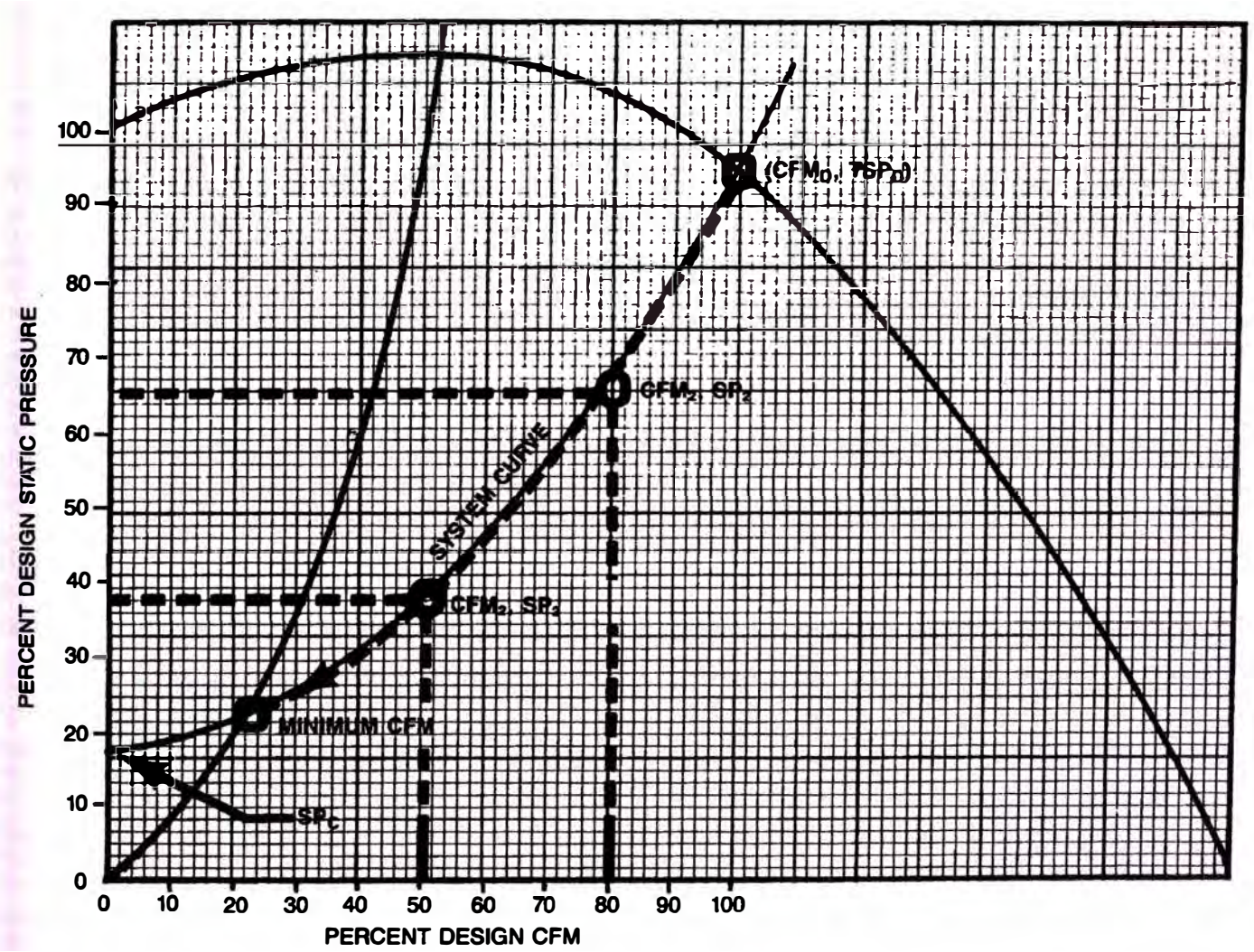
One of the most common methods of fan modulation is the use of inlet guide vanes. Inlet vanes are offered for unit sizes 106 through 134 with forward curved fans and 114 through 190 with airfoil fan wheels. Fan volume reduction with inlet vanes is accomplished by pre-spinning the air in the direction of fan rotation. The effect of pre-spinning results in decreased air delivery, static pressure and brake horsepower. For each position of inlet guide vanes, a new fan curve is created. Brake horsepower reductions cannot be read directly off the fan curve on inlet vane applications because a new fan curve is generated as the inlet vane closes.

It is also difficult to estimate turndown capability on inlet vane applications. Any time a VAV system with terminal boxes is controlled by a static pressure sensor, a system resistance curve is developed which passes through the design operating point and a minimum static pressure control point. This system curve will affect where the fan will cross into the unstable operating range. An illustration of inlet vane turndown is presented in Figure 13.

Inlet vanes operate most efficiently when the fan is chosen at or near peak efficiency. Inlet guide vanes offer good power savings, wide modulation range, and low maintenance.

NOTE: Fan performance with inlet vane control at other than wide open position is not within the scope of our central station air handler certification program with ARI.

Figure 14. Mechanical Drive Reduction Factors



Find design cfm and total static pressure. Calculate system line with the following formula:

$$SP_2 = \frac{TSP - SP_C}{(CFM_D)^2} \times (CFM_2)^2 + SP_C$$

SP_C = Control static required to operate VAV boxes.
CFM_2, SP_2 = Points less than design condition used to develop system line.
CFM_D, TSP_D = Design condition.

Engineering guide specifications

General

Furnish and install where shown on the plans, McQuay central station air handling units. Sizes, types and performance shall be as indicated in the unit schedule. Cabinets shall be of sectionalized construction and all sheet metal parts, including accessories, shall be fabricated of continuous galvanized steel. Access to individual sections shall be noted in the section details to follow.

Blower Section

Fan cabinet section shall be [uninsulated] [internally insulated with (1"-¾ lb.) (1"-1½ lb.) (1"-3 lb.) neoprene coated or (1"-¾ lb.) foil faced glass fiber secured to panels with a waterproof adhesive] [insulated with 2"-1½ lb. glass fiber insulation and internally with galvanized sheet metal liner]. Access to the interior of blower section shall be provided through easily removable access panels. Sizes 114–190 access to the interior of the blower section shall be provided through large hinged access doors utilizing Southco type quick-opening latches.

All fans shall be [forward curved] [airfoil] DWDI type with galvanized steel scroll housing. Fans shall be dynamically balanced before and after installation in the fan cabinet section. Fan shafts shall be made of solid steel. All fan wheels over 12" in diameter shall be keyed to the shaft. Maximum fan rpm shall be well below the first critical speed. Bearings shall be self-aligning, grease lubricated, ball type with a minimum 200,000 hour life. All bearings shall be equipped with lubrication fittings and have grease fittings extended to the exterior drive side of the cabinet (sizes 103–172)/grease fittings mounted internal to unit (size 190). Motors shall be mounted exterior to the cabinet (sizes 103–111 and high pressure). Motor shall be mounted internal to the cabinet (sizes 114–190, except high pressure). Motors located as shown on the submittal drawings. Fan performance shall be ARI certified where applicable.

High Pressure Blow-through Fan Section — Fans shall be airfoil DWDI type with galvanized steel scroll housing. The fan section shall be an independent section joined to companion sections with factory furnished 30 oz. neoprene coated, glass fiber flexible connector.

Rigid Mount — Fan and motor assembly shall be secured to the cabinet structure. External isolation of the unit is required.

Internal Isolation (Sizes 114–172) — Fan assembly shall be provided with 2" deflection internally mounted spring vibration isolation under the fan and motor base with spring thrust restraints securing the fan housing to the discharge opening panel. Fan motor shall be internally mounted.

Internal Isolation (Size 190) — Fan assembly provided with 1" deflection internally mounted spring vibration isolation under the fan and motor base with spring thrust restraints securing the fan housing to the discharge opening panel. Fan motor shall be internally mounted.

Forward Curved Fan with Optional Variable Inlet Guide Vanes shall have heavy-duty linkage connecting both inlet vane assemblies. The inlet vane actuating mechanism shall be permanently lubricated and interconnected by a solid steel shaft through two lubricated pillow block bearing assemblies mounted in the fan housing.

Airfoil Fan with Optional Variable Inlet Guide Vanes shall be controlled with a center hub linkage for complete accessibility. Vanes shall be fabricated from steel with baked enamel finish capable of withstanding entering air temperatures up to 200°F. The inlet vane actuating mechanism shall be permanently lubricated and interconnected by a solid steel shaft through two lubricated pillow block bearing assemblies mounted in the fan housing.

Singlezone Cooling Coil Section

All cooling coil section panels shall be [internally insulated with (1"-¾ lb.) (1"-1½ lb.) (1"-3 lb.) neoprene coated glass fiber insulation or (1"-¾ lb.) foil faced insulation] [insulated with 2"-1½ lb. glass fiber insulation and iknternally protected with galvanized sheet metal liners].

Coil section shall be provided with V-shaped slope drain pan with a minimum of ½" per linear foot pitch. Drain pan shall be provided with two connections, one on each side of the unit, and located at the lowest point on the pan. Drain pan shall be continuous galvanized steel with mastic coating or stainless steel. Drain pan shall be thermally isolated from unit casing with a full thickness of cabinet insulation. Drain pan shall be accessible for inspection and cleaning without removal of coils.

All coils shall be arranged within the coil section for horizontal airflow. Where multiple cooling coils are used in a single stacked arrangement, intermediate drain pans shall be provided between each coil. Coil headers and refrigerant distributors shall be completely enclosed within the insulated casing with only the connections extending through the cabinet. Coils shall be removable from coil section through removable access panels, both sides. Disassembly of entire coil section must not be required. Blow-through coil sections shall be provided with air diffuser plates to assure proper air distribution across the face of the coil.

2-Deck & 3-Deck Multizone Blow-through Cooling Coil Section

All cooling coil section panels shall be internally insulated with (1"-¾ lb.) (1"-1½ lb.) (1"-3 lb.) neoprene coated glass fiber insulation or (1"-¾ lb.) foil faced insulation.

Coil headers and refrigerant distributors shall be completely enclosed within the insulated casing with only the connections extending through the cabinet. Coils shall be removable from coil section through removable access panels, both sides. Disassembly of entire coil section must not be required. Coil section shall be provided with V-shaped slope drain pan with a minimum of ½" per linear foot pitch. Drain pan shall be provided with two connections, one on each side of the unit, and located at the lowest point on the pan. Drain pan shall be [continuous galvanized steel with mastic coating] [stainless steel]. Drain pan shall be thermally isolated from unit casing with 1" thick insulation. Drain pan shall be accessible for inspection and cleaning without removal of coils.

Coil sections shall be provided with air diffuser plates to assure proper air distribution across the face of the coil. Balance plates shall be furnished when required. The hot and cold deck partitions shall be insulated.

Multizone Dampers — Zone dampers shall be low leak type with bronze end and side seals on the hot and cold deck zones. Damper blades shall be positively locked in position to common shaft with rotation angles of 90 degrees, requiring one actuator per zone. Damper rods shall rotate in nylon bushings.

Unit Coils

Coil performance data shall be certified in accordance with ARI Standard 410. Coil performance shall be substantiated by computer generated output data.

Water Coils — All coils shall be provided with **[aluminum]** [copper] plate type fins for high capacity and structural strength. Fins shall have a minimum thickness of [.006"] [.0075"] [.0095"] with full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Tubes shall be mechanically expanded into the fins to provide a continuous primary to secondary compression bond over the entire finned length for maximum heat transfer rates. Bare copper tube shall not be visible between fins. Fins shall not have openings punched in them to accumulate lint and dirt.

Water coils shall be provided with headers of seamless copper tubing with intruded tube holes to permit expansion and contraction without creating undue stress or strain. Coil connections shall be **[carbon steel]** [copper] [cupronickel] [admiralty] with connection size to be determined by manufacturer based upon the most efficient coil circuiting. Vent connections shall be provided at the highest point to assure proper venting. Drain connections shall be provided at the lowest point to insure complete drainage and prevent freeze-up.

Refrigerant Coils — All coils shall be designed for use with Refrigerant [R-22] [R-134a]. All coils shall be provided with **[aluminum]** [copper] plate type fins for high capacity and structural strength. Fins shall have a minimum thickness of [.006"] [.0075"] [.0095"] with full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Tubes shall be mechanically expanded into the fins to provide a continuous primary-to-secondary compression bond over the entire finned length for maximum heat transfer rates. Bare copper tube shall not be visible between fins. Fins shall not have openings punched in them to accumulate lint and dirt.

Refrigerant coils shall be provided with round seamless [½"] [⅝"] O.D. copper tubes on 1½" centers, staggered in the direction of airflow. All joints shall be brazed.

Sweat type copper suction connections shall be located at the bottom of the suction headers for gravity oil drainage. Coils shall be circuited for [row] [face] [row and face] control capacity reduction. Pressure type liquid distributors shall be used. Coils shall be tested with 315 pounds air pressure under warm water, and suitable for 250 psig working pressure. Coils shall be dehydrated with 140°F DB, 40°F dew point air before shipment. Coils hydrostatically tested shall be not permitted. Coils shall be ARI certified and Underwriters Laboratories, Inc. listed. All coil shall be circuited in a counterflow manner with uniform circuits.

Steam Coils — All coils shall be provided with **[aluminum]** [copper] plate type fins for high capacity and structural strength. Fins shall have a minimum thickness of [.006"] [.0075"] [.0095"] [.012"] with full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Tubes shall be mechanically expanded into the fins to provide a continuous primary-to-secondary compression bond over the entire finned length for maximum heat transfer rates. Bare copper tube shall not be visible between fins. Fins shall not have openings punched in them to accumulate lint and dirt.

Steam coils shall be provided with round seamless [⅝"] [1"] O.D. **[copper]** [cupronickel] [admiralty] tubes on 1½" centers (⅝" coils) or 3" centers (1" coils). Tubes on two-row coils shall be staggered in the direction of airflow. All joints shall be brazed.

Steam coil headers shall be made of nonferrous materials using seamless copper tubing with intruded tube holes to permit expansion and contraction without creating undue stress or strain. Both the supply and return headers shall be completely encased by the coil casing. Coil shall be pitched in the unit to assure positive condensate drainage. Orificed baffle plates shall be installed in the supply header opposite the supply connection to ensure proper diffusion of entering steam.

Steam coils shall be tested with 315 pounds air pressure under warm water and guaranteed for 150 psig working pressures.

Mixing Box/Combination Angular Filter and Mixing Box

Section shall be provided with flanges for duct connections and optional top, bottom, or back openings.

With Dampers — Dampers shall be parallel blade and opposed acting to merge fresh air and return air airstreams as they enter the mixing box. Damper assemblies shall be provided with airfoil type low leak dampers. Damper assemblies shall have a leakage rate of less than two-tenths of one percent leakage at 2 inches static pressure differential. Leakage rate shall be tested in accordance with the Air Movement and Controls Association (AMCA) Standard 500. Dampers shall be hollow core, fully gasketed, fully insulated. Continuous vinyl seals shall be provided between damper blades. Stainless steel end seals shall be provided along the ends of dampers. Linkage shall be provided as part of ABS plastic endcaps to assure smooth, quiet operation.

Combination Angular Filter Mixing Box — Angular filter rack shall be provided with capability to house 2" thick filers as identified in unit data. Access to the filters shall be available through access doors on both sides. Filters shall be [throwaway] [cleanable] type.

Base Section/Combination Filter and Base Section (Unit Sizes 103–128)

Section shall be provided with flanges for duct connections.

With Dampers — Dampers shall be parallel blade and opposed acting to merge fresh air and return air airstreams as they enter the mixing box. Damper assemblies shall be provided with airfoil type low leak dampers. Damper assemblies shall have a leakage rate of less than two-tenths of one percent leakage at 2 inches static pressure differential. Leakage rate shall be tested in accordance with the Air Movement and Controls Association (AMCA) Standard 500. Dampers shall be hollow core, fully gasketed, fully insulated. Continuous vinyl seals shall be provided between damper blades. Stainless steel end seals shall be provided along the ends of dampers. Linkage shall be provided as part of ABS plastic endcaps to assure smooth, quiet operation.

Combination Filter and Base Section — Angular filter rack shall be provided with capability to house 2" thick filters as identified in unit data. Access to the filters shall be available through access doors on both sides. Filters shall be [throwaway] [cleanable] type.

Filter Section

Flat Filter Section — Flat filter section shall provide capability to house 2″ or 4″ thick filters as identified in unit data. Filter section shall have access panels on both ends and shall be constructed of galvanized steel. Filters shall be [throwaway] [cleanable] type.

Angular Filter Section — Angular filter/heavy-duty angular section shall provide capability to house extended filter surface area for 2″ thick filers. Filter section shall have hinged access doors on both sides and shall be constructed of galvanized steel. Filters shall be [throwaway] [cleanable] type.

Unit Size 190 Filter Section — Filter racks shall be suitable for use with [2″ angular (throwaway, pleated, or cleanable] [AAF rigid or bag filter media (with) or (without) throwaway prefilters]. Full-sized hinged access doors shall be provided as standard.

AAF AccessAir filter section shall provide capability to house 2″ or 4″ prefilters and 4″ cartridge filters. Filter section shall have hinged access doors on both sides of unit and shall be constructed fo 16-gauge galvanized steel.

Filter section shall be suitable for use with AAF 100X, 300X or 301 prefilter media, and 4″ AAF Varicel II cartridge filters. The cartridge filters shall have an efficiency of [90-95%] [80-85%] [60-65%] as determined by the ASHRAE 52-76 test method. Final filter classified as U.L. Class 2 when tested according to U.L. Standard 900.

Extended Side Access Filter Section — AAF AccessAir filter section shall provide capability to house 2″ or 4″ prefilters and 12″ cartridge filters or 15″ bag filters. Filter section shall have hinged access doors on both sides of unit and shall be constructed of 16-gauge galvanized steel.

Filter section shall be suitable for use with AAF 100X, 300X or 301 prefilter media, and 12″ AAF Varicel I cartridge filters or 15″ DriPak bag filters. The cartridge filters shall have an efficiency of [90-95%] [80-85%] [60-65%] as determined by the ASHRAE 52-76 test method and shall be classified U.L. Class I when tested according to U.L. Standard 900. The bag filters shall have an efficiency of 40-45% as determined by the ASHRAE 52-76 test method and classified U.L. Class 2 when tested according to U.L. Standard 900.

Roll Filter Section (Unit Size 103–172) — AAF Roll-O-Matic filter housing shall be constructed of 16-gauge galvanized steel. Access doors on both ends of the unit shall be provided. Housing shall be [uninsulated] [insulated with 1″ 3 lb. mastic coated insulation on inside of unit exposed to airflow]. Housing shall withstand 6″ W.G. static pressure. Housing shall be provided with roll filter media and timed or pressure advance mechanism and actuator. Filter media shall be AAF Roll-O-Matic.

Filter media shall be tested in accordance with ASHRAE Standard 52-76 and have an average arrestance of not less than 83%.

Bag Filter Section — AAF Series 33 filter section shall provide capability to house 2″ or 4″ prefilters and up to 21″ deep bag filters. Filter section shall have hinged access doors on both sides of unit and shall be constructed of 16-gauge galvanized steel.

Filter section shall be suitable for use with AAF 100X, 300X, or 301 prefilter media and up to 21″ DriPak bag filters. The bag filters shall have an efficiency of [90-95%] [80-85%] [60-65%] as determined by the ASHRAE 52-76 test method and classified U.L. Class 2 when tested according to U.L. Standard 900.

Extended Bag Filter Section — AAF Series 33 filter section with 12″ extension shall provide capability to house 2″ or 4″ prefilters and up to 37″ deep bag filters. Filter section shall have hinged access doors on both sides of unit and shall be constructed of 16-gauge galvanized steel.

Filter section shall be suitable for use with AAF 100X, 300X, or 301 prefilter media and up to 37″ DriPak bag filters. The bag filters shall have an efficiency of [90-95%] [80-85%] [60-65%] as determined by the ASHRAE 52-76 test method and classified U.L. Class 2 when tested according to U.L. Standard 900.

Access Section

Access section shall be provided to allow access to interior of unit through large hinged doors utilizing quick-opening latches.

Air handler computer selection program

To provide optimal air handler unit selection, McQuay provides ARI certified microcomputer air handler selection capibility. The computer program will select the most economical unit size and coils to meet the specification. Both draw-through and blow-through unit designs in low, medium and high pressure configurations are included in the program. The program can select a wide variety of coils including chilled and hot water, chilled and hot water with glycol, steam and direct expansion. The coil selection portion of the program is ARI certified for those coils which fall within the ARI certification program.

To operate the MS-85™ software the user needs a microcomputer using MS/DOS. McQuay will provide the software to run the air handler selection program.

For special application needs, our mainframe computer can select coils involving very high or low temperatures, special heat transfer fluids, heat reclaim coils and condenser coils.

Contact your nearest McQuay representative for a copy of the MS-85™ software or for an air handler selection that meets the most exacting specifications.

Contact your McQuay representative today!

McQuay International

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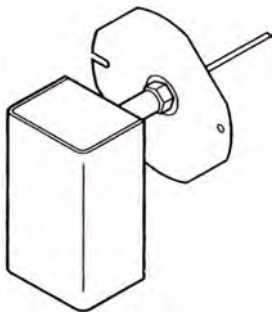
Remote Thermistor Temperature Sensors

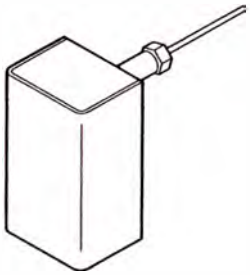
Electronic thermistor sensing of temperature at remote room locations, ducts, liquid lines, tanks, outdoor air, etc. for use with microprocessor-based energy management systems (TS-5700 series) and NETWORK 8000™ (TS-5700-850 series).

Features:

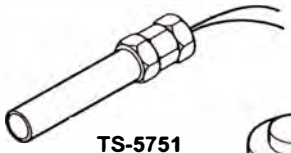
- Network 8000 compatible — 850 series.
- Low drift per year.
- High gain.
- Economical sensors.
- Two temperature ranges to meet specific needs.



TS-5721
TS-5721-850

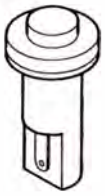


TS-5721-851 **TS-5721-101**
TS-5722-851 **TS-5722-101**
TS-5721-853† **TS-5721-901†**
TS-5722-853† **TS-5722-901†**
† AT 225 bulb well included



TS-5751
TS-5751-850

TS-5721-102
TS-5721-854



TS-5771
TS-5771-850

TS-5721-110
TS-5722-110
TS-5721-852
TS-5722-852

Model Chart

Used with Microprocessor-Based System.

Model No.	Description	Mounting Connection	Dimensions in. (mm)		Wiring Connections
			Element Dia. x L	Wiring Enclosure	
TS-5721	Duct/ immersion[a]	Plate 1/4 in. NPT [a]	1/4 x 8 (6 x 203)	3-1/2 H x 2-1/4 W x 2-1/4 D (89 x 57 x 57) with 2-1/2 (64) extension to element. 1/2 in. knockouts (top & bottom)	12 in. (305 mm)
TS-5721-101 TS-5722-101	Immersion[b]	1/4 in. NPT nut [b]	1/4 x 4 (6 x 102)		
TS-5721-901 TS-5722-901	Immersion	1/4 in. NPT nut[c]	1/4 x 4 (6 x 102)		
TS-5721-110 TS-5722-110	Strap-on	Nylon wire tie[d]	1/4 x 2-1/4 (6 x 57)	None	
TS-5721-102	Duct	Plate	5/16 x 7-3/4 (8 x 197)	None (can be mounted in a NEMA standard 5-16-1984 handy box)	1/4 in. spade connections (2 female conn. provided)
TS-5751	Outdoor	1/2 in. conduit	1-1/8 x 5 (29 x 127)	None	3 ft. (0.9 m) brown pigtail leads
TS-5771	Unitary[e]	17/32 in. (13.5 mm) dia. mtg. hole [e]	3/4 x 1-1/4 (19 x 32)	None	1/4 in. spade connectors (2 female conn. provided)

[a] Immersion requires AT-226 bulb well.
[b] Immersion requires AT-255 bulb well.
[c] AT-255 bulb well included.
[d] Factory supplied 2-1/2 x 2 in. (64 x 51 mm) foam insulation tape and 30 in. (762 mm) nylon wire tie for 1-1/2 to 8 in. (38 to 203 mm) dia. pipes.
[e] For mounting through fan coil of unit ventilator cabinet of similar application. Ambient humidity limits, 5 to 95% RH, non-condensing.

sed with NETWORK 8000 System.

Model No.	Description	Mounting Connection	Dimensions in. (mm)		Wiring Connections
			Element Dia. x L	Wiring Enclosure	
TS-5721-850	Duct/ immersion[a]	Plate 1/4 in. NPT [a]	1/4 x 8 (6 x 203)	3-1/2 H x 2-1/4 W x 2-1/4 D (89 x 57 x 57) with 2-1/2 (64) extension to element. 1/2 in. knockouts (top & bottom)	12 in. (305 mm)
TS-5721-851 TS-5722-851	Immersion[b]	1/4 in. NPT nut [b]	1/4 x 4 (6 x 102)		
TS-5721-853 TS-5722-853	Immersion	1/4 in. NPT nut[c]	1/4 x 4 (6 x 102)		
TS-5721-852 TS-5722-852	Strap-on	Nylon wire tie[d]	1/4 x 2-1/4 (6 x 57)	None	
TS-5721-854	Duct	Plate	5/16 x 7-3/4 (8 x 197)	None (can be mounted in a NEMA standard 5-16-1984 handy box)	1/4 in. spade connections (2 female conn. provided)
TS-5751-850	Outdoor	1/2 in. conduit	1-1/8 x 5 (29 x 127)	None	3 ft. (0.9 m) brown pigtail leads
TS-5771-850	Unitary[e]	17/32 in. (13.5 mm) dia. mtg. hole [e]	3/4 x 1-1/4 (19 x 32)	None	1/4 in. spade connectors (2 female conn. provided)

[a] Immersion requires AT-226 bulb well

[b] Immersion requires AT-255 bulb well.

[c] AT-255 bulb well included.

[d] Factory supplied 2-1/2 x 2 in. (64 x 51 mm) foam insulation tape and 30 in. (762 mm) nylon wire tie for 1-1/2 to 8 in. (38 to 203 mm) dia. pipes.

[e] For mounting through fan coil of unit ventilator cabinet of similar application. Ambient humidity limits, 5 to 95% RH, non-condensing.

pecifications

ensing element

TS-5700 series	Thermistor resistance, 10,000 Ω (TS-5721-XXX) or 30,000 Ω (TS-5722-XXX series only) at 77°F (25°C).
TS-5700-850 series	Thermistor resistance, 10,000 Ω (TS-5721-85X) or 30,000 Ω (TS-5722-85X series only) at 77°F (25°C) shunted with an 11k Ω 0.1% resistor.
32 to 158°F (0 to 70°C)	Error: ±0.36°F (±0.2°C) maximum.
	Drift/year: 0.045°F (0.025°C), maximum.
Over operating temperature limits	Error: ±0.76°F (±0.42°C) maximum, except ±0.36°F (±0.2°C) maximum for TS-5771 series.
	Drift/year: 0.09°F (0.05°C), maximum.
Nominal resistance values	Refer to Temperature vs. Resistance Table.

Ambient Temperature Limits °F (°C).

Part Number	Shipping & Storage	Operating
TS-5721	-40 to 250 (-40 to 121)	-40 to 250 (-40 to 121)
TS-5721-101		
TS-5721-110		
TS-5721-901		
TS-5721-850	-40 to 160 (-40 to 71)	
TS-5721-851		
TS-5721-852		
TS-5721-853		
TS-5721-102		-40 to 140 (-40 to 60)
TS-5721-854		
TS-5722-101	-40 to 250 (-40 to 121)	85 to 250 (29 to 121)
TS-5722-110		
TS-5722-901		
TS-5722-851	-40 to 160 (-40 to 71)	
TS-5722-852		
TS-5722-853		
TS-5751	-40 to 220 (-40 to 104)	-40 to 140 (-40 to 60)
TS-5751-850	-40 to 160 (-40 to 71)	
TS-5771		40 to 140 (4 to 60)
TS-5771-850		

Temperature vs. Resistance.

Nominal Resistance Values (in 1000 Ω)				
Temp °F (°C)	TS-5721 TS-5721-101 TS-5721-102 TS-5721-110 TS-5721-901 TS-5751 TS-5771	TS-5721-850 TS-5721-851 TS-5721-852 TS-5721-853 TS-5721-854 TS-5751-850 TS-5771-850	TS-5722-101 TS-5722-110 TS-5722-901	TS-5722-851 TS-5722-852 TS-5722-853
-40 (-40)	239.8	10.517	—	—
-22 (-30)	135.2	10.172	—	—
-4 (-20)	78.91	9.654	—	—
14 (-10)	47.54	8.933	—	—
32 (0)	29.94	8.044	—	—
50 (10)	18.79	6.938	—	—
68 (20)	12.26	5.798	—	—
77 (25)	10.00	5.238	30.00	8.049
86 (30)	8.194	4.696	24.582	7.599
104 (40)	5.592	3.875	16.776	6.644
122 (50)	3.893	3.707	11.679	5.665
140 (60)	2.760	2.206	8.280	4.724
158 (70)	1.990	1.685	5.970	3.870
176 (80)	1.458	1.287	4.734	3.180
194 (90)	1.084	0.986	3.252	2.510
212 (100)	0.816	0.760	2.448	2.002
230 (110)	0.623	0.590	1.869	1.598
248 (120)	0.482	0.462	1.446	1.278

ccessories

Model No.	Description
T-226	Brass bulb well for TS-5721 and TS-5721-850.
T-225	Stainless steel bulb well for TS-5721-101, TS-5722-101, TS-5721-851, and TS-5722-851.

ypical Applications

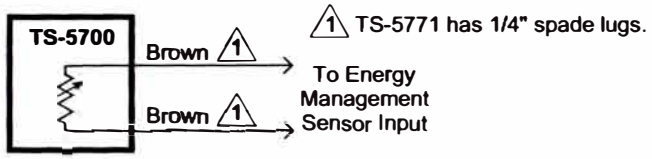
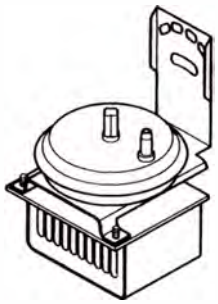


Figure 1 TS-5700 Series Sensor Connections.

Figure 2 TS-5700-850 Series Sensor Connections.

Static and Velocity Pressure Transmitter

These transmitters control static and velocity pressure. Their output signal can also provide a reset action, typically raising the control point of a central cooling controller.



Features:

- Static or velocity controller.
- Continuous pressure indication signal.
- System 8000 compatible.
- Reset applications.

Model Chart

Model No.[a]	Inputs in. (mm) W.C.		
	Velocity Pressure	Static Pressure	Maximum Tap Over Pressure
PP-8616	1.5 to 6 (38.1 to 152.4)	0.04 to 6 (1 to 152.4)	50 (1270)
PP-8621	0.01 to 1.5 (0.25 to 38.1) [400 to 4800 ft./min at 70°F (2.03 to 24.38 m/s at 21°C)]	—	15 (381)

[a] CAUTION: This product contains a half-wave rectifier power supply and must not be powered off transformers used to power other devices utilizing non-isolated full-wave rectifier power supplies.

Specifications

Inputs	Refer to Model Chart.
Outputs	1 to 11 Vdc (2 mA) at IO2.
Adjustments	None.
Power requirements	20 ±1 Vdc at 20 mA or 24 Vac at 0.5 VA.
Environment	
Ambient temperature limits	Shipping and storage: -40 to 160°F (-40 to 71°C). Operating: 40 to 140°F (4 to 60°C).
Humidity	5 to 95% RH, non-condensing.
Locations	NEMA Type 1.
Vibration	Must not exceed 0.5 G at 50 to 250 Hz.
Connections	Refer to Figure 1.
Wiring	Coded screw terminals.
Air pressure taps	2 high and 2 low, barbed fittings for 1/4 in. (6.35 mm) O.D. plastic tubing.
Cover	Aluminum.
Mounting	±15° from horizontal on vertical surface. Avoid locations near high radio frequency or electromagnetic interference generating devices.
Dimensions	4-3/4 H x 4-7/8 W x 5-7/8 D in. (120 x 122 x 149 mm).
Velocity pressure sensor	Use flow stations providing traverse and averaging results. The PP-8000 series units are usable with air station pickups.

Accessories

Model No.	Description
AP-302	Duct static pressure sensing tip for pressure 1 in. (25.4 mm) W.C. and up.
AP-305	Duct static pressure sensing tip for pressure 0.01 in. (0.3 mm) W.C. and up.
ASP-589-015	W.C. velocity pressure indication meter, 0 to 1-1/2 in. (0 to 38 mm).
ASP-589-060	W.C. static pressure indication meter, dual scale, 0 to 6 in. (0 to 152 mm).

Typical Applications

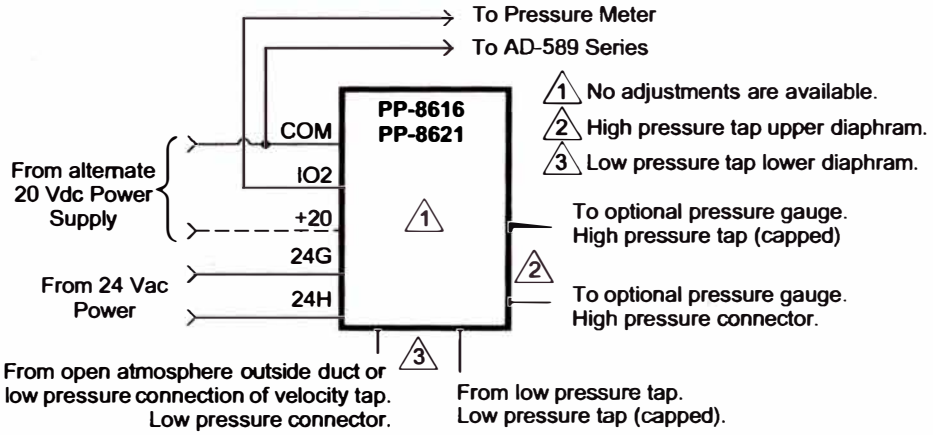
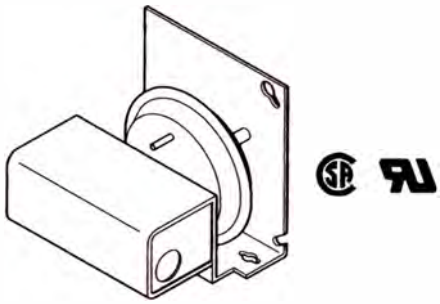


Figure 1 Typical Connections for PP-8616 or PP-8621 Transmitter.

Two-Position Air Flow Pressure Switch

This switch provides low or line voltage control of pressure for air and non-combustible gases. It controls static pressure, total pressure, or differential total pressure.



Features:

- High/low pressure taps.
- Adjustable from 0.07 to 1 in. (1.8 to 25.4 mm) W.C.
- Universal mounting.
- Agency approved.

Model Chart

Model No.	Description
PC-301	Refer to Specifications.

Specifications

Setpoint	
Factory setting	0.07 in. (1.8 mm) W.C.
Field adjustment	0.07 to 1 in. (1.8 to 25.4 mm) W.C.
Sensing element	Neoprene diaphragm.
Differential	0.04 in. (1 mm) W.C. at minimum setpoint to 0.1 in. (3 mm) W.C. at maximum setpoint.
Environment	
Ambient temperature limits	Shipping and storage: -40 to 140°F (-40 to 60°C). Operating: 35 to 140°F (o to 60°C).
Humidity	5 to 95% RH, non-condensing.
Locations	NEMA Type 1.
Maximum pressure	12 in. (305 mm) W.C.
Electrical switch	
Type	Snap action SPDT.
Ratings	Refer to Maximum Electrical Switch Ratings Table.
Connections	Refer to Figure 1.
Wiring	Coded screw terminals.
High pressure taps	One barbed fitting for 3/8 in. O.D. plastic tubing.
Low pressure taps	One barbed fitting for 1/4 in. O.D. plastic tubing.
Case	All metal with 1/2 in. conduit opening.
Mounting	In vertical position on any surface free of vibration.
Dimensions	5-1/8 H x 4-3/4 W x 4-3/8 D in. (130 x 121 x 111 mm).

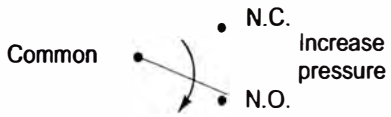
Maximum Electrical Switch Ratings.

Vac	Full Load Amps	Locked Rotor Amps	Pilot Duty (VA)	Non-Inductive Amps
24 V	—	—	60	10
120 V	6.25	37.5	300	
240 V	3.1	18.6		
277 V	2.7	16.2		

Accessories

Model No.	Description
AP-302	Duct static pressure sensing tip for pressure 1 in. (25.4 mm) W.C. and up.
AP-305	Duct static pressure sensing tip for pressure 0.01 in. (0.3 mm) W.C. and up.
AT-208	Duct mounting bracket for probes other than AP-302 and AP-305.

Typical Applications



N.O. makes on increase of pressure.

Figure 1 Switch Action for PC-301 Switch.

ANEXO D

PRESUPUESTO DEL PROYECTO

PROYECTO TELEFONICA EDIFICIO GRIMALDO DEL SOLAR
SISTEMA DE AIRE ACONDICIONADO Y VENTILACION
PROPUESTA ECONOMICA PP-212-04/98 / PP-213-04/98

ITEM	DESCRIPCION	UNIDAD	CANT	P. UNIT. US $	P.TOTAL US $
1.0.0	**SISTEMA DE VENTILACION SOTANOS**				
1.1.0	Extractor de aire tipo centrífugo EC-S		3,00	3.736,02	11.208,06
1.2.0	Suministro e Instalación de Ductos metálicos	Kg	1.832,00	3,45	6.320,00
1.3.0	Suministro e Instalación de rejillas de extracción de pared	pulg²	18.880,00	0,21	3.964,00
1.3.1	Suministro e Instalación de rejillas de extracción para el piso	pulg²	84.989,00	0,24	20.402,00
1.4.0	Interconexión Eléctrica	glb			2.574,00
	Total ITEM 1.0.0				**44.468,06**
3.0.0	**SISTEMA DE AIRE ACONDICIONADO Y VENTILACION**				
3.1.0	Chiller Tornillo enfriado por agua	Un	2,00	69.429,48	138.858,96
3.1.2	Control Panel	Glb			2.600,00
3.2.0	Torres de Enfriamiento	Un	2,00	10.260,00	20.520,00
3.3.0	Equipo ablandador de agua	glb			4.345,00
3.4.0	Tanque de Compensación	Un	1,00	803,72	803,72
3.5.0	Bombas de agua helada Primarias EAH-01	Un	2,00	2.967,80	5.935,60
3.5.1	Bombas de agua helada Secundarias EAH-02	Un	2,00	1.706,84	3.413,68
3.6.0	Bombas de Condensación EAC-01	Un	2,00	3.334,16	6.668,32
	Total ITEM 3.0.0				**183.145,28**
3.7.0	**FAN COILS DE AGUA HELADA**				
3.7.1	FC-1-1	Un	1,00	1.819,02	1.819,02
3.7.2	FC-1-2 / FC-1-3	Un	2,00	1.454,08	2.908,16
3.7.3	FC-1-4	Un	1,00	1.814,76	1.814,76
3.7.4	FC-2-1	Un	1,00	820,76	820,76
3.7.5	FC-T	Un	9,00	886,08	7.974,72
3.7.6	FC-CI	Un	1,00	1.065,00	1.065,00
	Total ITEM 3.7.0				**16.402,42**
4.0.0	**UNIDADES MANEJADORAS DE AIRE**				
4.1.0	UM-2	Un	1,00	4.989,88	4.989,88
4.1.1	UM-T	Un	9,00	5.540,84	49.867,56
4.1.2	UM-CI	Un	1,00	5.951,22	5.951,22
	Total ITEM 4.0.0				**60.808,66**
5.0.0	**EXTRACTORES DE AIRE TIPO CENTRIFUGO**				
5.1.0	EC-02	Un	1,00	678,76	678,76
5.2.0	EC-01	Un	1,00	678,76	678,76
	Total ITEM 5.0.0				**1.357,52**
6.0.0	**INYECTOR DE AIRE TIPO CENTRIFUGO**				
6.1.0	IC-01	Un	1,00	678,76	678,76
	Total ITEM 6.0.0				**678,76**
7.0.0	**EXTRACTOR AXIAL**				
7.1.0	EA-01	Un	1,00	403,28	403,28
	Total ITEM 7.0.0				**403,28**
8.0.0	**RED DE TUBERIAS AGUA HELADA CON AISLAMIENTO**				
8.1.0	Diámetro 1"	mt	1.000,00	23,78	23.784,00
8.2.0	Diámetro 1¼"	mt	150,00	92,87	13.931,00
8.3.0	Diámetro 1½"	mt	6,00	188,67	1.132,00
8.4.0	Diámetro 2"	mt	48,00	92,02	4.417,00
8.5.0	Diámetro 2½"	mt	211,00	111,11	23.444,00
8.6.0	Diámetro 3"	mt	29,00	93,72	2.718,00
8.7.0	Diámetro 4"	mt	15,00	128,33	1.925,00
8.8.0	Diámetro 5"	mt	31,00	328,81	10.193,00
8.9.0	Diámetro 6"	mt	138,00	229,80	31.712,00

PROYECTO TELEFONICA EDIFICIO GRIMALDO DEL SOLAR
SISTEMA DE AIRE ACONDICIONADO Y VENTILACION
PROPUESTA ECONOMICA PP-212-04/98 / PP-213-04/98

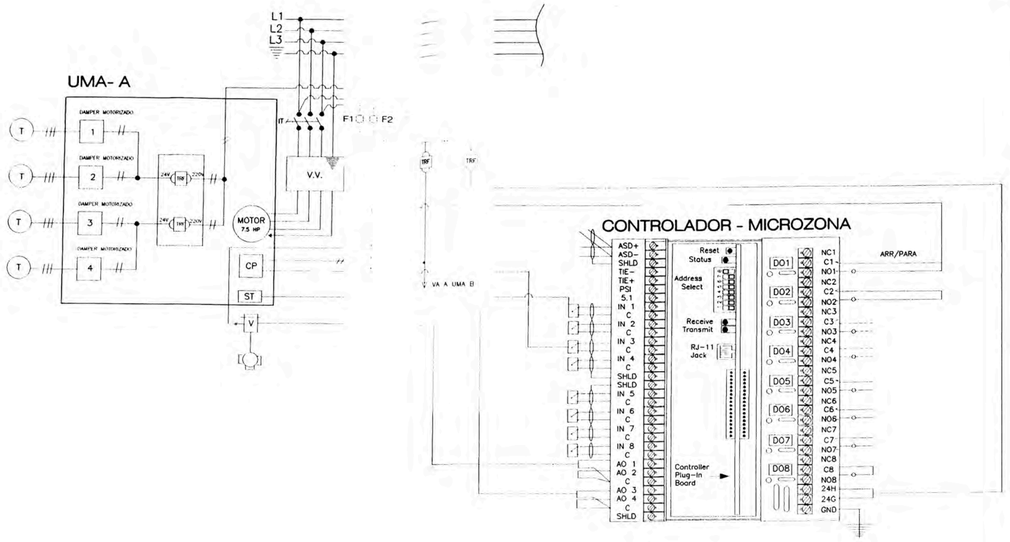
ITEM	DESCRIPCION	UNIDAD	CANT	P. UNIT. US $	P.TOTAL US $
	Total Item 8.0.0				**113.256,00**
9.0.0	**RED DE TUBERIAS AGUA DE CONDENSACION**				
9.1.0	Diámetro 8"	mt	168,00	75,84	12.741,14
9.2.0	Diámetro 6"	mt	35,00	173,68	6.078,86
	Total Item 9.0.0				**18.820,00**
10.0.0	**DAMPERS MOTORIZADOS**				
10.1.0	Damper de 30" x 20"	Un	1,00	300,33	300,33
10.2.0	Damper de 54" x 18"	Un	1,00	414,64	414,64
10.3.0	Damper de 30" x 16"	Un	1,00	283,29	283,29
10.4.0	Damper de 46" x 18"	Un	10,00	316,87	3.168,73
10.5.0	Damper de 18" x 18"	Un	30,00	289,68	8.690,40
10.6.0	Damper de 19" x 14"	Un	1,00	274,06	274,06
10.7.0	Damper de 18" x 14"	Un	1,00	274,06	274,06
10.8.0	Damper de 24" x 14"	Un	1,00	279,03	279,03
10.9.0	Damper de 20" x 14"	Un	1,00	274,06	274,06
10.10.	Damper de 14" x 14"	Un	10,00	271,22	2.712,20
	Total ITEM 10.0.0				16.670,80
11.0.0	**DUCTOS DE PLANCHA GALVANIZADA**				
11.1.0	Suministro / Instalación de Ductos p' extracción de baños	Kg	543,00	3,45	1.874,00
11.2.0	Suministro / Instalación de Ductos metálicos para A/A	Kg	30.855,00	3,45	106.450,00
	Total ITEM 11.0.0				**108.324,00**
12.0.0	**AISLAMIENTO DE DUCTOS**				
12.1.0	Suministro / Instalación de aislamiento térmico para ductos	mt^2	4.807,00	8,60	41.340,00
	Total ITEM 12.0.0				**41.340,00**
13.0.0	**DIFUSORES Y REJILLAS**				
13.1.0	Suministro / Instalación Rejillas para extracción	$pulg^2$	906,00	0,12	110,00
13.2.0	Suministro / Instalación de Dif. y Rej. de aluminio para A/A	$pulg^2$	93.008,00	0,20	19.066,00
	Total ITEM 13.0.0				**19.176,00**
14.0.0	**AISLAMIENTO ACUSTICO**				
14.1.0	Suministro / Instalación de aislamiento acústico para ductos	mt^2	760,00	10,12	7.690,00
	Total ITEM 14.0.0				**7.690,00**
15.0.0	**ACCESORIOS DE AGUA HELADA Y CONDENSACION**				
15.1.0	Válvulas Multipropósito	Glb			2.112,96
15.2.0	Juntas Flexibles	Glb			1.001,10
15.3.0	Filtro colador	Glb			1.030,92
	Total ITEM 15.0.0				**4.144,98**
16.0.0	**MONTAJE DE EQUIPOS E INTERCONEXION DE DRENAJE**	**glb**			**2.900,00**
17.0.0	**INTERCONECCION ELECTRICA SISTEMA A/A**	**glb**			**17.132,00**
18.0.0	**SISTEMA DE CONTROL INTELIGENTE**				
18.1.0	Sistema diseñado para monitoreo y control	Un	1,00	57.463,14	57.463,14
	Total ITEM 18.0.0				**57.463,14**
19.0.0	**TRAZLADO E IZAJE DE CHILLER**	**glb**			**3.200,00**
20.0.0	**PRUEBAS - BALANCES - REGULACIONES DE SISTEMAS**	**glb**			**3.000,00**
	*** SUB - TOTAL PARTE IMPORTADA / NACIONAL EN DOLARES AMERICANOS**				**720.380,90**
	DESCUENTO ESPECIAL DEL 6,3%				**45.384,00**

PROYECTO TELEFONICA EDIFICIO GRIMALDO DEL SOLAR
SISTEMA DE AIRE ACONDICIONADO Y VENTILACION
PROPUESTA ECONOMICA PP-212-04/98 / PP-213-04/98

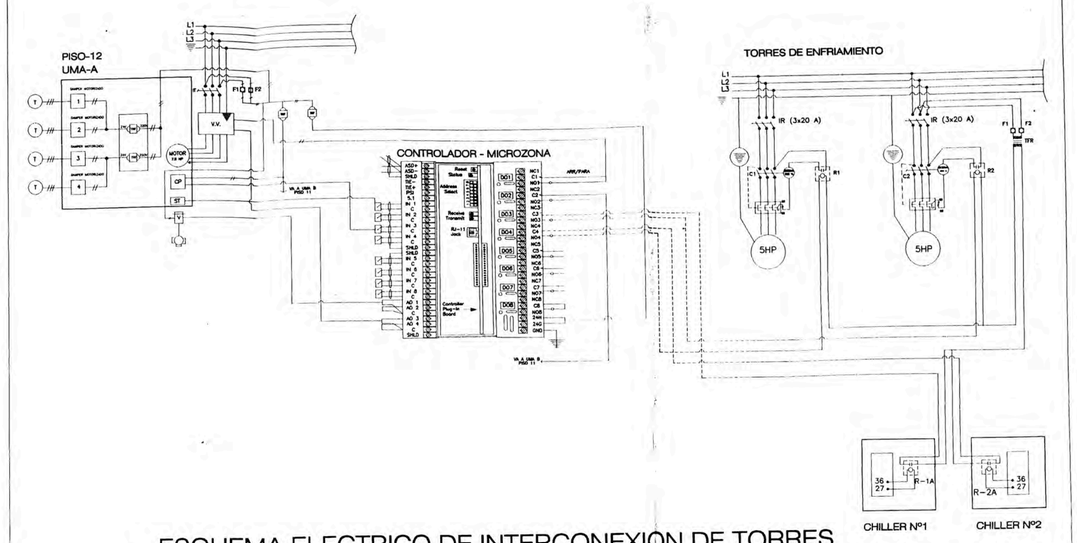
ITEM	DESCRIPCION	UNIDAD	CANT	P. UNIT. US $	P.TOTAL US $
	TOTAL PARTE IMPORTADA / NACIONAL EN DOLARES AMERICANOS				**674.996,90**
	* **IGV DEL 18%**				**121.499,44**
	* **TOTAL PARTE IMPORTADA / NACIONAL EN DOLARES AMERICANOS INCLUIDO EL IGV DEL 18%**				**796.496,35**

NOTA:

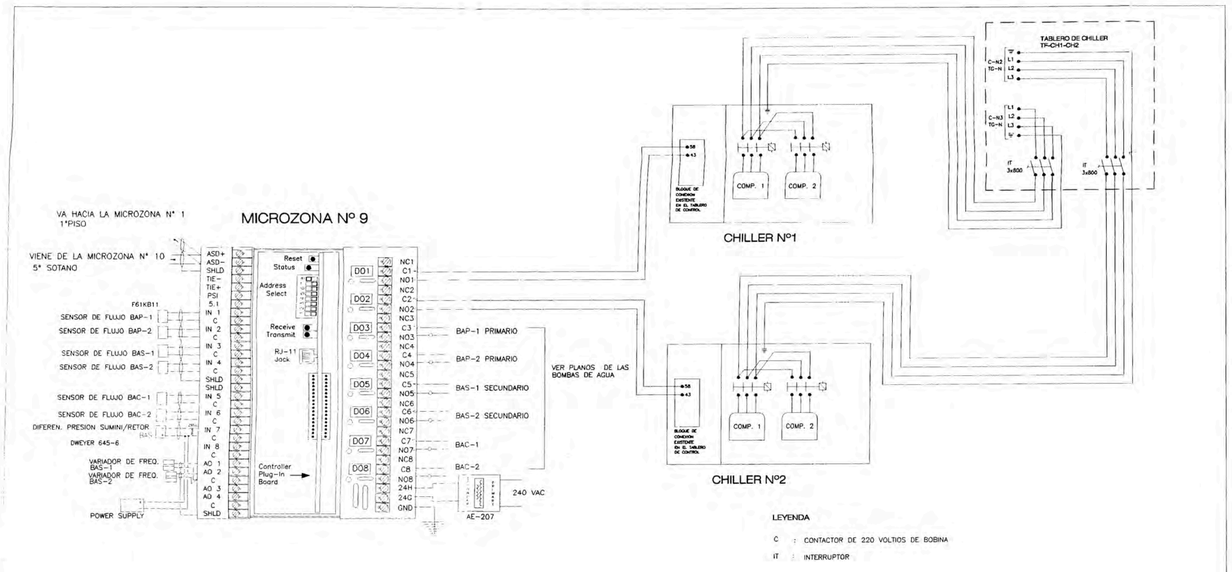
1. En caso variasen los tributos que afecten a los bienes de importación requeridos, decretados por el Gobierno como: Aranceles aduaneros, IGV u otros tributos legales; estos automatica - mente se considerará el precio variado en el mismo porcentaje o participación de la modifi - cación tributaria.
2. Trabajos para terceros:
   * Punto de alimentación eléctrica a no mas de 1 metro de distancia de las unidades, según especificaciones.
   * Punto de drenaje a no mas de 1 metro de distancia de las unidades, según especific.
   * Pases y resanes por cuenta de obra civil según especificaciones.
3. En caso no se utilize el Sistema Inteligente, no es necesario el Control Panel del Item 3.1.2



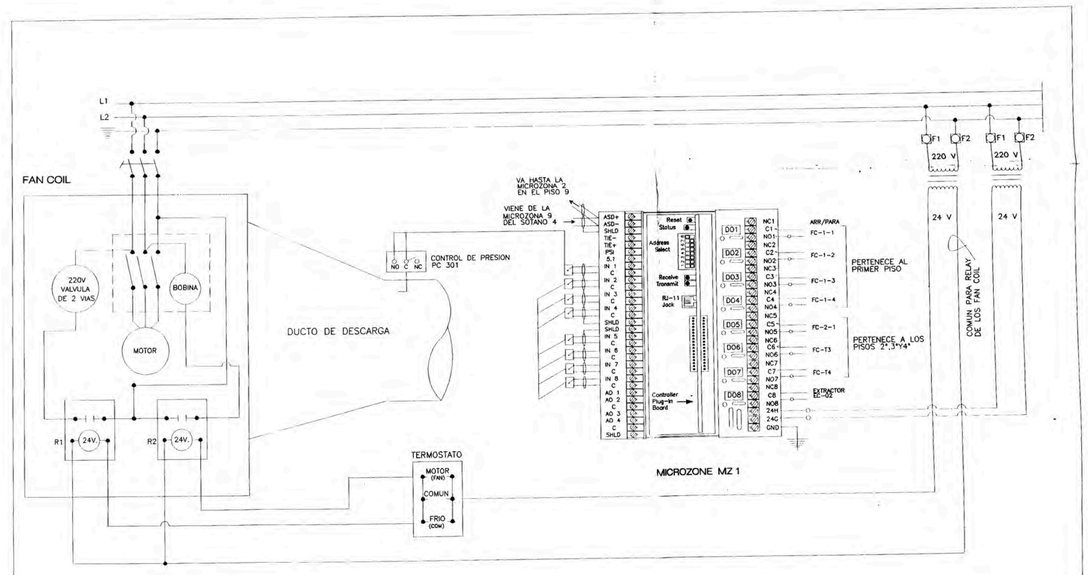
ESQUEMA ELECTRICO DE INTERCONEXION DE UNIDAD MANEJADORA DE AIRE
DESDE CONTROLADOR - MICROZONA (TIPICO)



ESQUEMA ELECTRICO DE INTERCONEXION DE TORRES
DE ENFRIAMIENTO DESDE CONTROLADOR - MICROZONA 3



ESQUEMA ELECTRICO DE INTERCONEXION DE CHILLERS
DESDE CONTROLADOR - MICROZONA

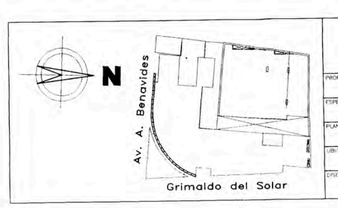


ESQUEMA ELECTRICO DE INTERCONEXION DE UNIDAD FAN COIL
DESDE CONTROLADOR - MICROZONA (TIPICO)

LEYENDA

R.T. = RELAY TERMICO
S.T. = SENSOR DE TEMPERATURA
D.M. = DAMPER MOTORIZADO
T.C. = TERMOSTATO
C.P. = CONTROL DE PRESION
R 1 = RELAY DE 24 VOLTIOS DE BOBINA (VENTILADOR)
R 2 = RELAY DE 24 VOLTIOS DE BOBINA (FRIO)
R-1A R-2A = RELAY DE 115 VOLTIOS DE BOBINA, CON CONTACTOS DE 24 VOLTIOS

C = CONTACTOR DE 220 VOLTIOS DE BOBINA
V = VALVULA DE 2 VIAS MOTORIZADA (ON – OFF, 220 V. – 60 Hz))
V. V. – VARIADOR DE VELOCIDAD
IT = INTERRUPTOR
TFR = TRANSFORMADOR
F-O = FUSIBLE



TERMO SISTEMAS s.a.
LOS EBANISTAS N°102 - URB. EL ARTESANO - ATE - VITARTE TELF. 4-359238 FAX. 4-376366

PROPIETARIO	TELEFONICA - GRIMALDO DEL SOLAR
ESPECIALIDAD	Sistema de Control Inteligente-Aire Acondicionado
PLANO	Esquemas As Built de Conexion
UBICACION	Calle Grimaldo del Solar N° 292 - Miraflores

LAMINA: SI-1
PROYECTO: CAD-007/99

DISEÑO	REVISADO	APROBADO	DIBUJO	FECHA	ESCALA
Tecn. T.L.A.	Ing. D.E.O.A.	Ing. F. Mejia	Tec. Z.J.G.	Diciembre 1999	S/E

TELEFONICA GRIMALDO

OFICINA CORPORATIVA

PERU

SIEBE [redacted]

BARBER COLMAN COMPANY

INDICE

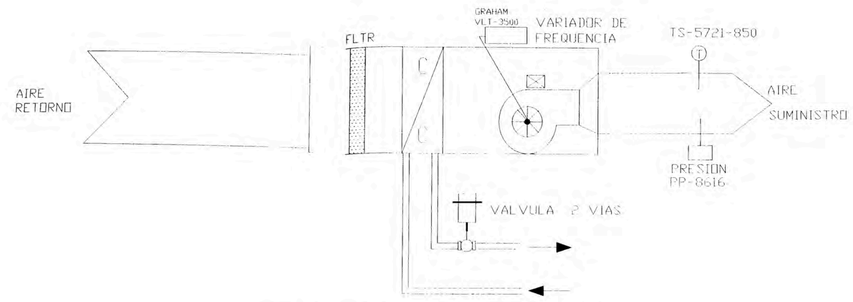
REVISIONS	
DATE	CHANGES
1/4/99	GENERAL

JOB NAME TELEFONICA GRIMALDO
LOCATION PERU
ARCHITECT
ENGINEER
CONTRACTOR
DRAWN BY J.P.
CHECKED BY R. PEREZ
DATE 07/30/98
DRAWING NO. C-1.

SIEBE

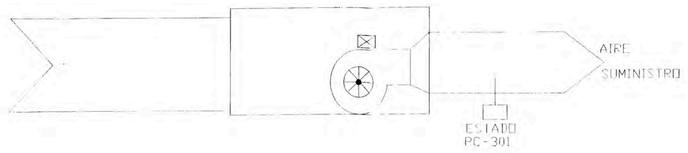
SISTEMA DE ENFRIAMIENTO Y VENTILACION

TELEFONICA GRIMALDO



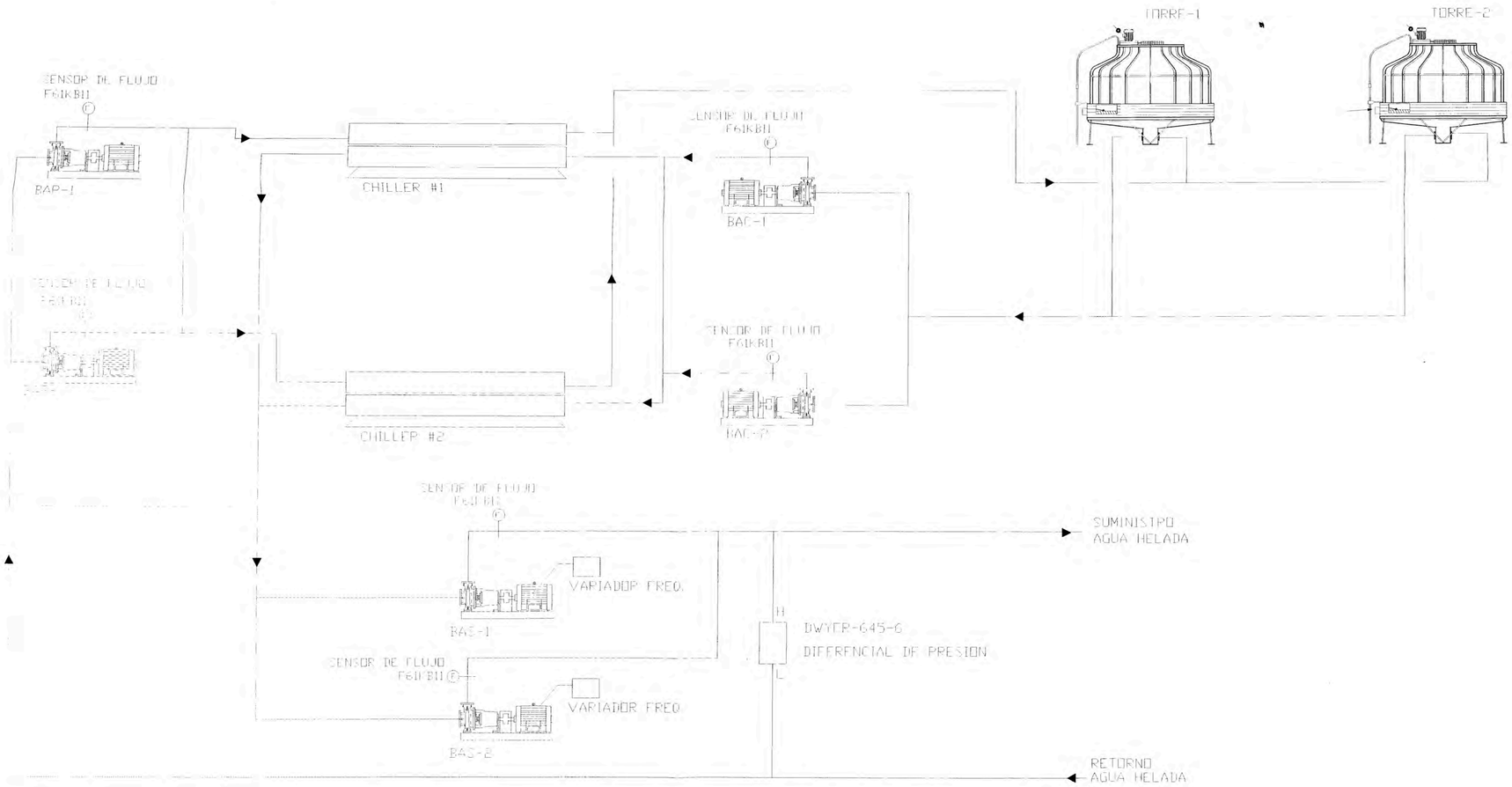
TIPICO PARA MANEJADORAS DE VOLUMEN VARIABLE

UMA-C1	UMA-T5
UMA-T2	UMA-T6
UMA-T3	UMA-T7
UMA-T4	UMA-T8
	UMA-T9
	UMA-T10
	UMA-T11



TIPICO PARA FANCOILS

FC-1-1	FC-T5
FC-1-2	FC-T6
FC-1-3	FC-T7
FC-1-4	FC-T8
FC-2-1	FC-T9
FC-1-3	FC-T10
FC-1-4	FC-T11
	FC-C1



SIEBE [redacted]

SISTEMA DE ENFRIAMIENTO Y VENTILACION

REVISIONS		
DATE	CHANGES	
1-4-94	GENERAL	

JOB NAME: TELEFONICA GRIMALDO
LOCATION: PERU
ARCHITECT:
ENGINEER:
CONTRACTOR:
DRAWN BY:
DATE:

TELEFONICA - GRIMALDO

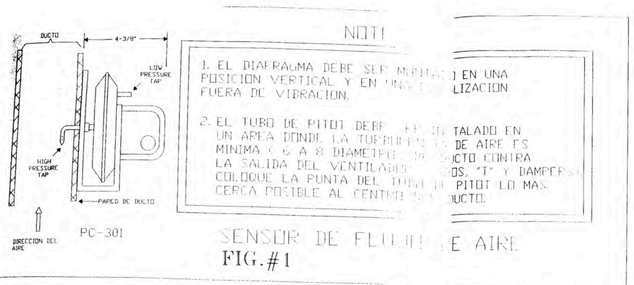


FIG.#1

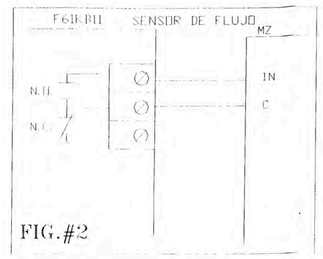


FIG.#2

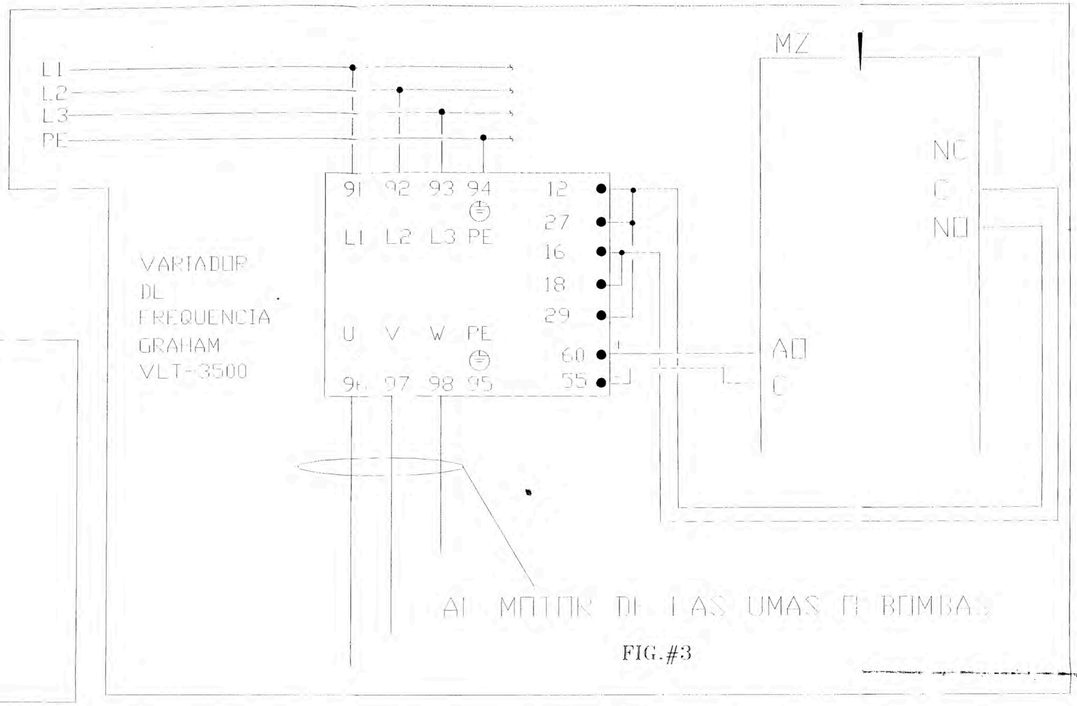


FIG.#3

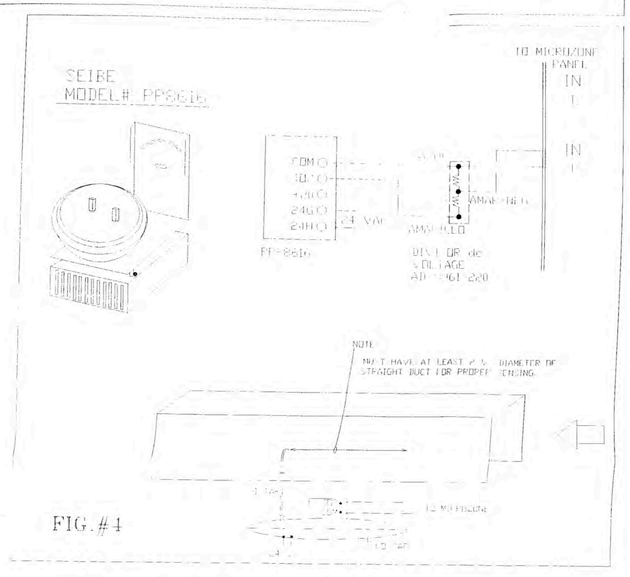


FIG.#4

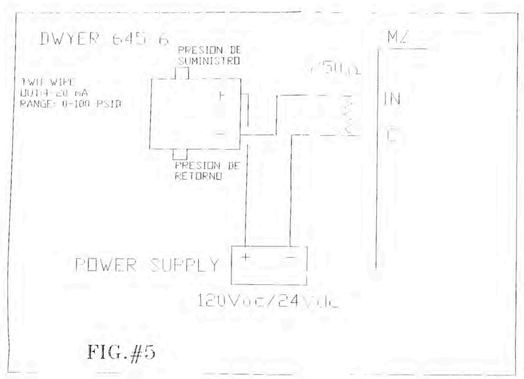


FIG.#5

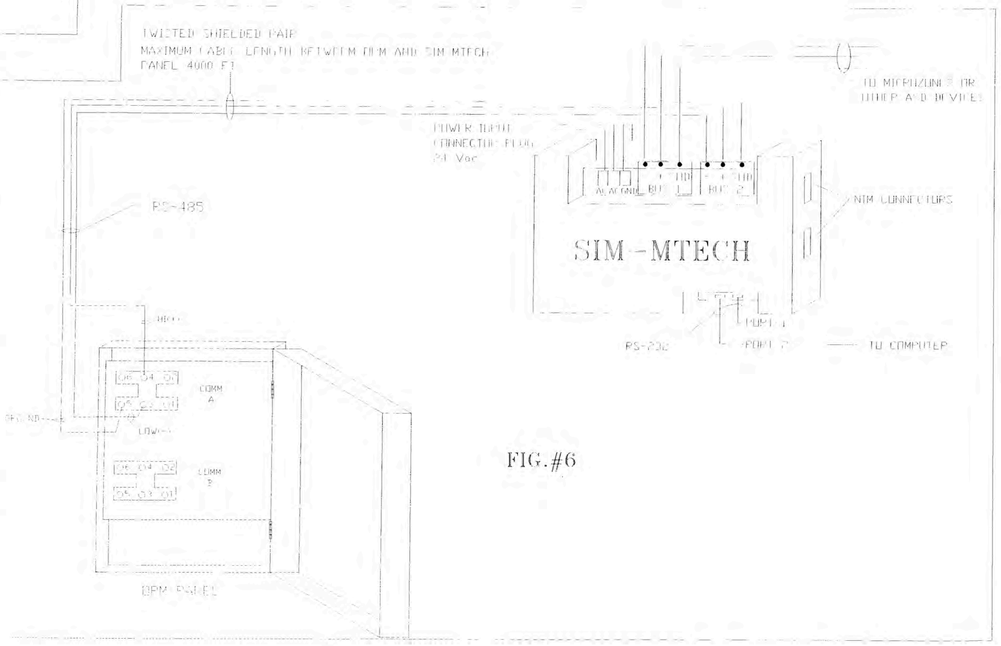


FIG.#6

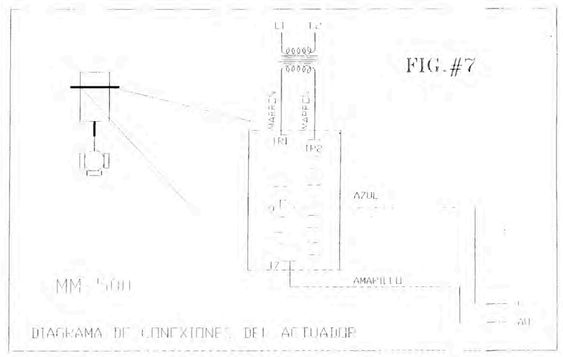


FIG.#7

SIEBE

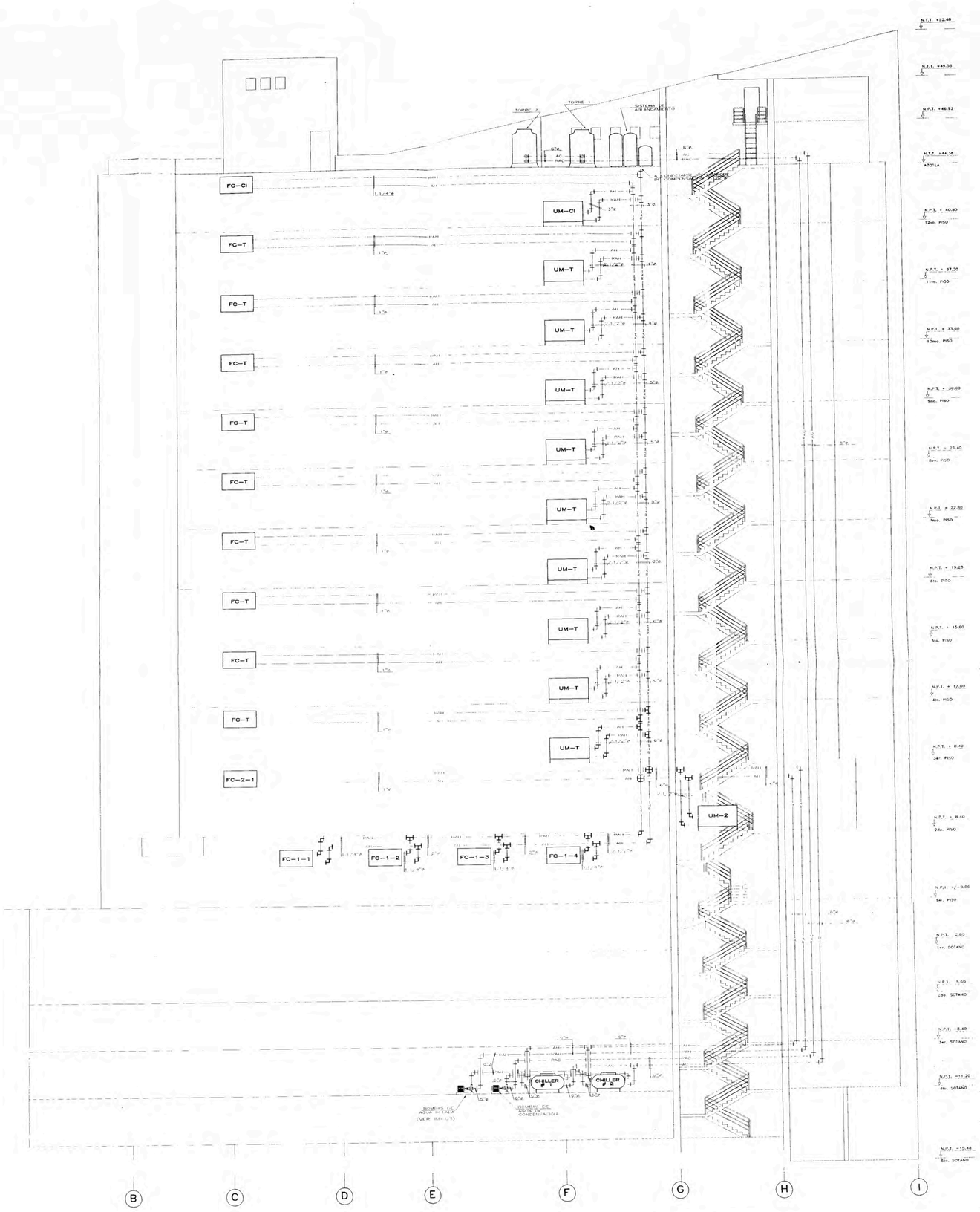
SISTEMA DE ENFRIAMIENTO Y VENTILACION

REVISIONS		
DATE	CHANGES	
1.1.98	GENERAL	

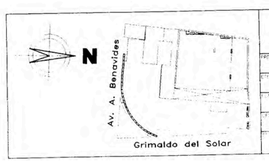
JOB NAME: TELEFONICA GRIMALDO
LOCATION: PERU
ARCHITECT:
ENGINEER:
CONTRACTOR:
DRAWN BY:
CHECKED BY:
DRAWING NO:

LEYENDA

SIMBOLO	DESCRIPCION
T	TUBERIA PARA TERMOSTATO 20mm Ø PVC.
AH	TUBERIA PARA AGUA HELADA DE ACERO ASTM A-53 GR. B CON AISLAMIENTO.
RAH	TUBERIA PARA RETORNO DE AGUA HELADA DE ACERO SCH 40, CON AISLAMIENTO.
AC	TUBERIA PARA AGUA DE CONDENSACION DE ACERO SCH 40.
RAC	TUBERIA PARA RETORNO DE AGUA DE CONDENSACION DE ACERO SCH 40.
GLP	TUBERIA PARA LLENADO DE GAS PROPANO DE ACERO SCH 40.
RG	TUBERIA PARA RETORNO DE GAS PROPANO DE ACERO SCH 40.
D.R.C.	DAMPER REGULADOR DE CAUDAL (MANUAL)
	DAMPER MANUAL
	DUCTO QUE SUBE.
	DUCTO QUE BAJA.
	DIFUSOR DE 4 TIROS.
	DIFUSOR DE 3 TIROS.
	DIFUSOR DE 2 TIROS.
RR	REJILLA DE RETORNO HORIZONTAL.
RV	REJILLA DE RETORNO VERTICAL.
	BOTONERA PARA ARRANQUE DE EQUIPOS.
	CODO RECTO 90°.
	TEE RECTA.
	TUBERIA QUE BAJA.
	TUBERIA QUE SUBE.
(E)	EQUIPO DE BOMBEO (EXISTENTE)
	CAMARA DE BUCHON.
	SALIDA EXISTENTE DUCTO
	TUBERIA
	TUBERIA
	MEDIDOR DE

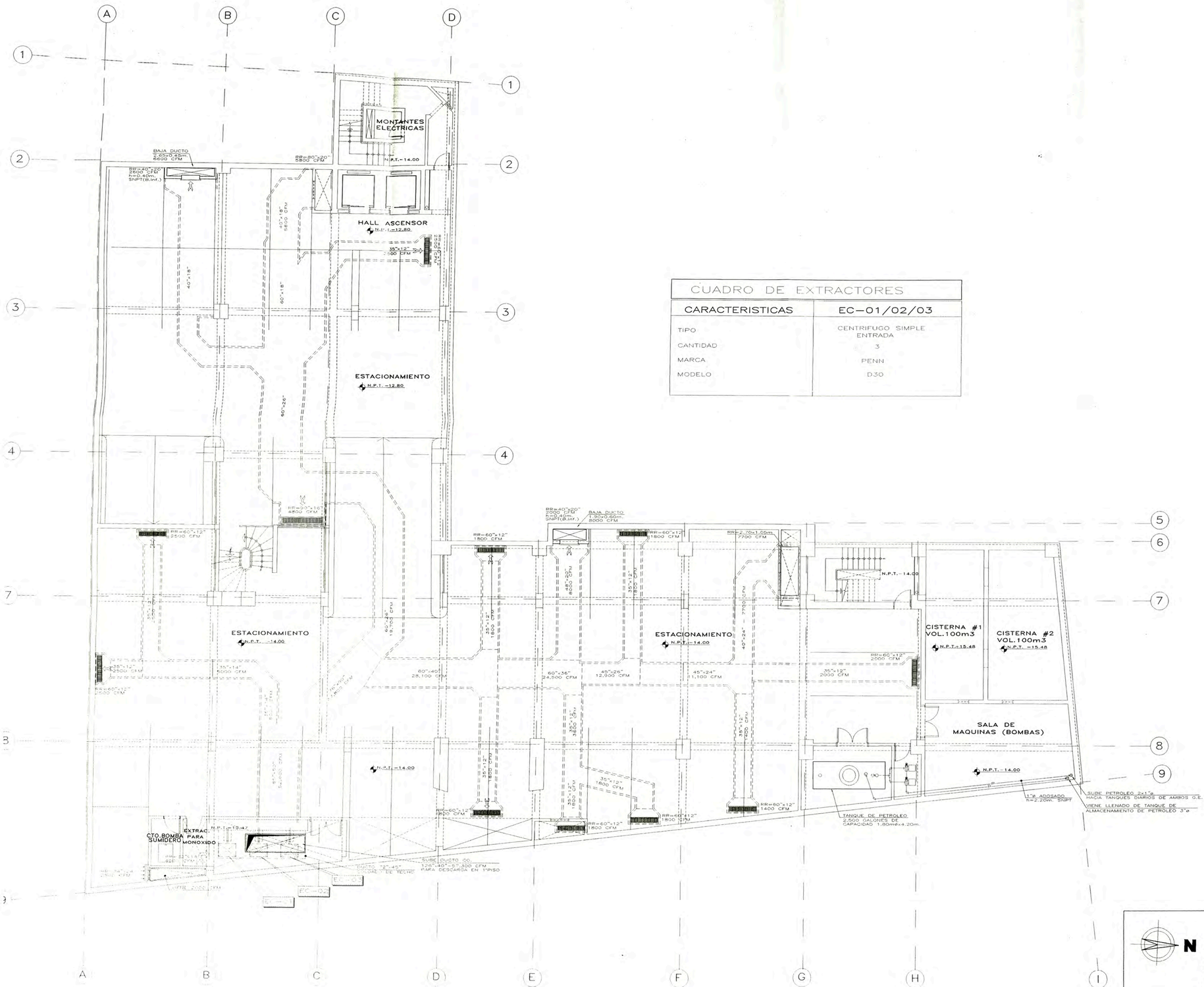


MONTANTE DE TUBERIAS (AH/RAH . AC/RAC)



TERMO SISTEMAS s.a.
LOS EBANISTAS N°102 - URB. EL ARTESANO - ATE - VITARTE TELF. 4-359238 FAX. 4-376366

PROYECTO: TELEFONICA - GRIMALDO DEL SOLAR					LAMINA: AA-01
CONTENIDO: Sistema de Aire Acondicionado					
PLANO: Montante de Tuberias y Leyendas					
UBICACION: Calle Grimaldo del Solar N° 292 - Miraflores					CAD-007/99
DISEÑO: Ing. D.E.O.A.	DIBUJO: Ing. D.E.O.A.	CALCULO: Ing. F. Mejia	REVISO: F. Bueno Ch.	FECHA: Diciembre 1999	ESCALA: 1/125

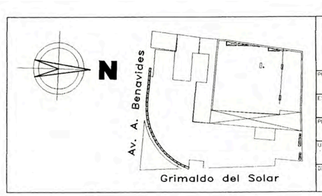


CUADRO DE EXTRACTORES

CARACTERISTICAS	EC-01/02/03
TIPO	CENTRIFUGO SIMPLE ENTRADA
CANTIDAD	3
MARCA	PENN
MODELO	D30

NOTAS :

1.- VER LEYENDA, NOTAS GENERALES Y DETALLES EN PLANO IM-01



TERMO SISTEMAS s.a.

LOS EBANISTAS N°102 - URB. EL ARTESANO - ATE - VITARTE TELF. 4-359238 FAX. 4-376366

PROPIETARIO :	TELEFONICA - GRIMALDO DEL SOLAR	LAMINA : AA-02
ESPECIALIDAD :	Sistema de Aire Acondicionado	
PLANO :	Planta 5º Sotano	
UBICACION :	Calle Grimaldo del Solar Nº 292 - Miraflores	PROYECTO : CAD-007/99

DIBUJO	REVISADO	APROBADO	DESARROLLO	FECHA	ESCALA
Ing. D.E.O.A.	Ing. D.E.O.A.	Ing. F. Mejia	F. Bueno Ch.	Diciembre 1999	1/125

ENFRIADORES DE AGUA (CHILLERS)		
CARACTERISTICAS	CHILLER #1	CHILLER #2
CANTIDAD	01	01
MARCA	MCQUAY	MACQUAY
MODELO	PFS 210	PFS 210

ELECTROBOMBAS DE AGUA DE CONDENSACION (EAC - 01-02)	
CANTIDAD	02
MARCA	TACO
MODELO	FE 3013

ELECTROBOMBAS DE AGUA HELADA (EAH - 01-02)	
TIPO	VOLUMEN VARIABLE SECUNDARIA
CANTIDAD	02
MARCA	TACO
MODELO	FE 3007

ELECTROBOMBAS DE AGUA HELADA (EAH - 01-02)	
TIPO	VOLUMEN VARIABLE PRIMARIA
CANTIDAD	02
MARCA	TACO
MODELO	FE 2513

PLANTA TERCER SOTANO

PLANTA CUARTO SOTANO

DETALLE Nro 1

NOTAS :

1.- VER LEYENDA, NOTAS GENERALES Y DETALLES EN PLANO IM-01

TERMO SISTEMAS s.a.

LOS EBANISTAS N°102 - URB. EL ARTESANO - ATE - VITARTE TELF. 4-359238 FAX. 4-376366

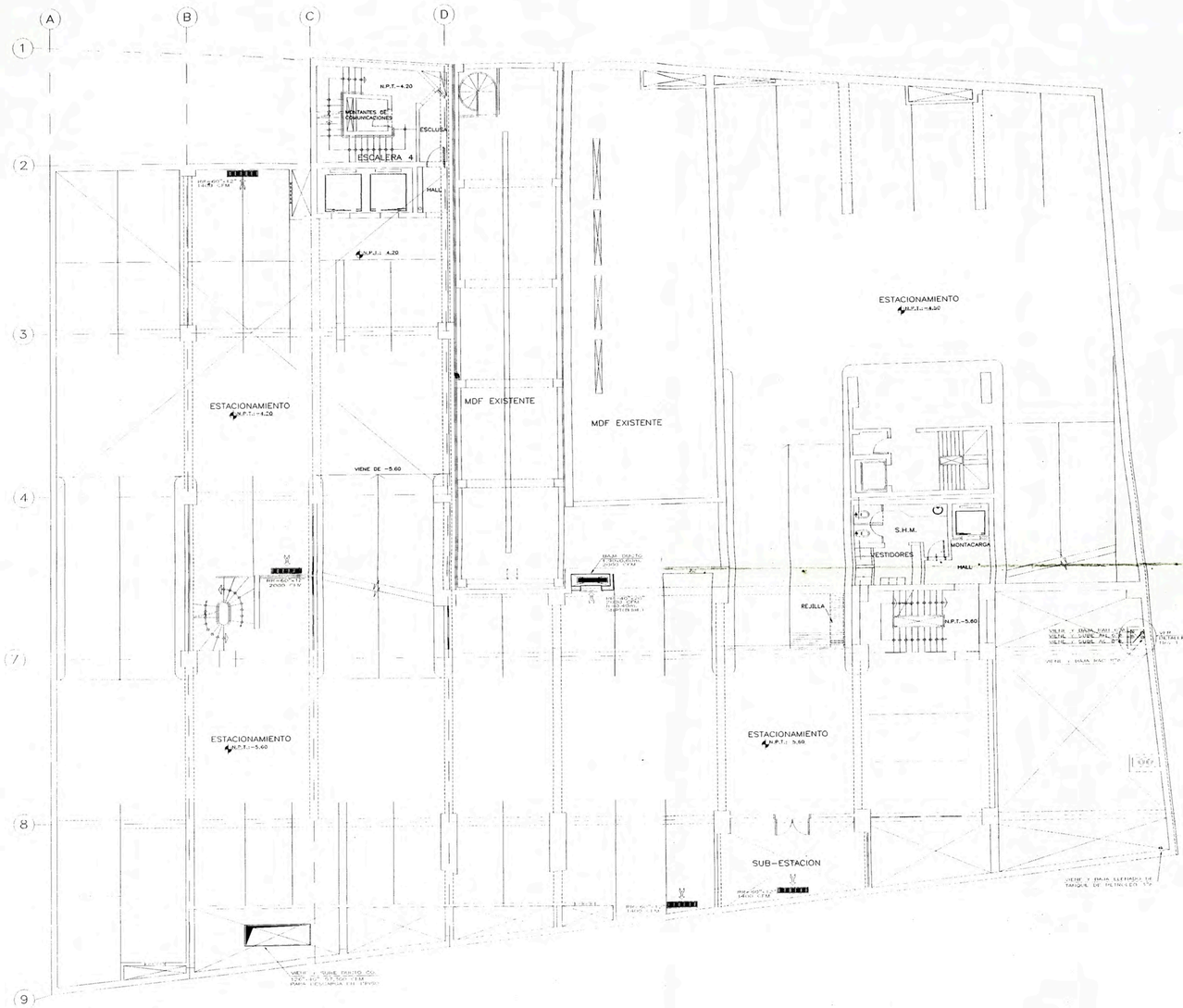
TITULO DEL PROYECTO:	TELEFONICA - GRIMALDO DEL SOLAR
TITULO DEL PLANO:	Sistema de Aire Acondicionado
UBICACION:	Planta 3° y 4° Sotano
	Calle Grimaldo del Solar N° 292 - Miraflores

Ing. D.E.O.A.	Ing. D.E.O.A.	Ing. F. Mejia	F. Bueno Ch.	Diciembre 1999	1/150

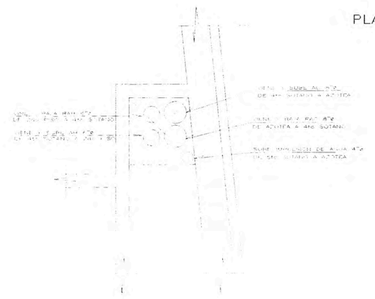
PLANO: AA-03

CAD-007/99

PLANTA PRIMER SOTANO



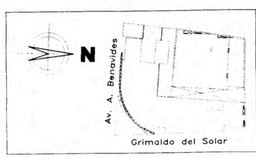
PLANTA SEGUNDO SOTANO



DETALLE Nro 1

NOTAS :

1.- VER LEYENDA, NOTAS GENERALES Y DETALLES EN PLANO IM-01



TERMO SISTEMAS s.a.

LOS EBANISTAS N°102 - URB. EL ARTESANO - ATE - VITARTE TELF. 4-359238 FAX. 4-376366

TELEFONICA - GRIMALDO DEL SOLAR	
Sistema de Aire Acondicionado -Ventilacion Mecanica	AA-04
Planta 1 y 2° Sotanos	
Calle Grimaldo del Solar N° 292 - Miraflores	CAD-007/99

Ing. D.E.O.A.	Ing. D.E.O.A.	Ing. F. Mejia	F. Bueno Ch.	Diciembre 1999	1/150

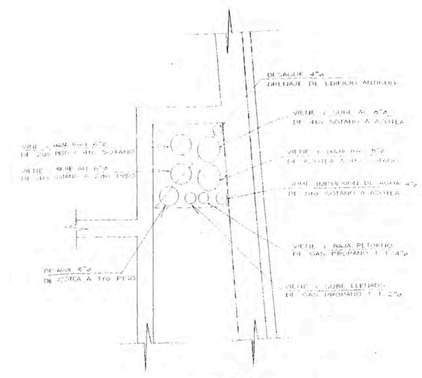
EQUIPOS DE AIRE ACONDICIONADO				
CARACTERISTICAS	FC-1-1	FC-1-2	FC-1-3	FC-1-4
TIPO	FAN-COIL	FAN-COIL	FAN-COIL	FAN-COIL
CANTIDAD	1	1	1	1
MARCA	McQUAY	McQUAY	McQUAY	McQUAY
MODELO	SHB 301B	SHB 201B	SHB 201B	SHB 301B

CLAVE DE DIFUSORES
① DIF=10"x10"
② DIF=12"x12"
③ DIF=6"x6"

CLAVE DE REJILLAS
① RR 16"x10"

EXTRACTOR AXIAL (EA-01)	
CANTIDAD	1
MARCA	Penn
MODELO	P10RA

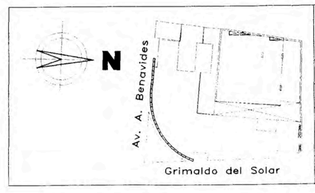
INYECTOR DE AIRE (IC-01)	
CANTIDAD	1
MARCA	Penn
MODELO	ZC 10



NOTAS :

1.- VER LEYENDA, NOTAS GENERALES Y DETALLES EN PLANO IM-01

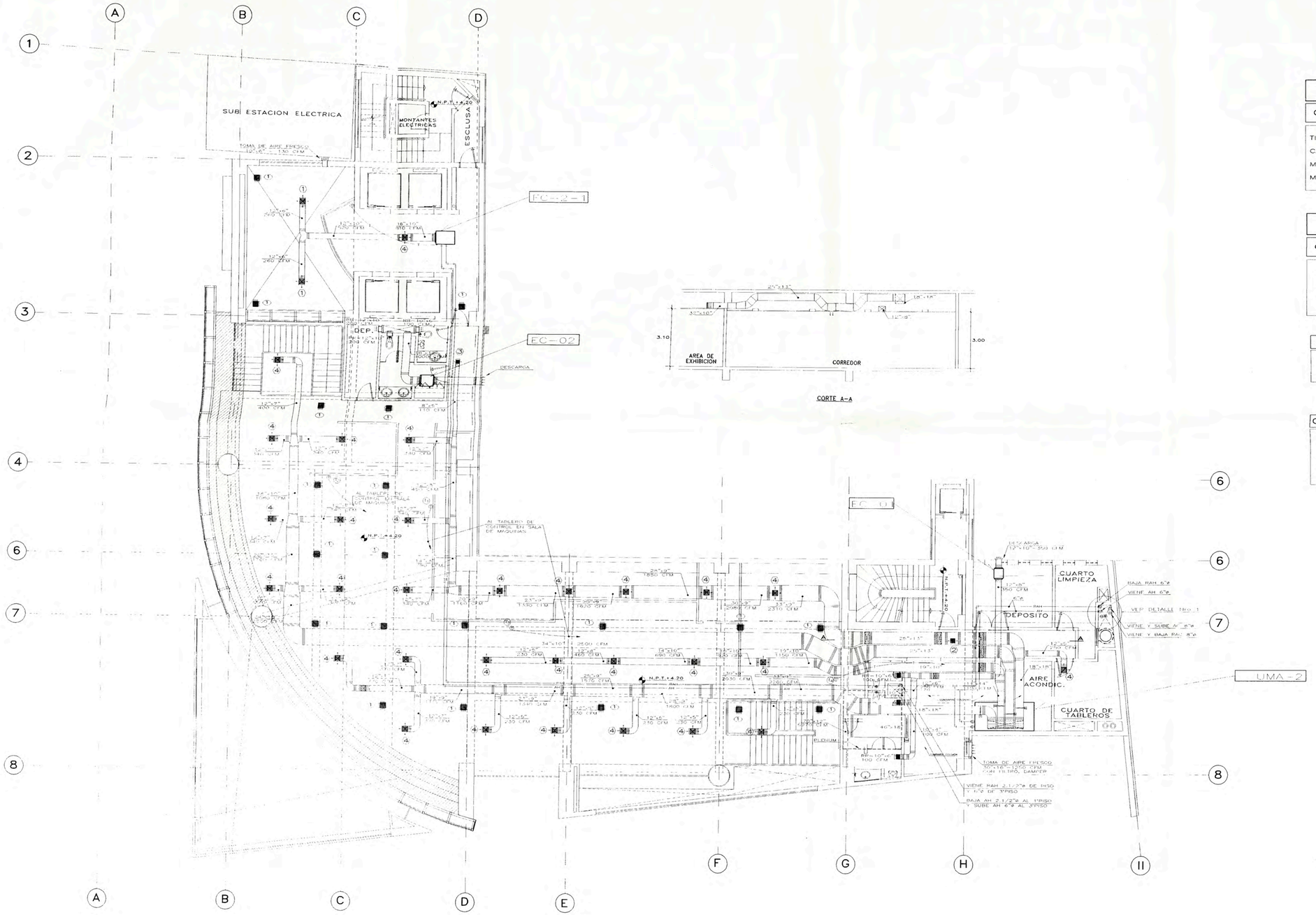
2.- MODIFICACIONES EN DUCTOS POR CAMBIO DE FALSO CIELO DE TIPO AMSTRONG A MINI- CELL



TERMO SISTEMAS s.a.

LOS EBANISTAS N°102 - URB. EL ARTESANO - ATE - VITARTE TELF. 4-359238 FAX. 4-376366

PROYECTO	TELEFONICA - GRIMALDO DEL SOLAR
DESCRIPCION	Sistema de Aire Acondicionado
PISO	Planta 1° Piso
UBICACION	Calle Grimaldo del Solar N° 292 - Miraflores
DIBUJO: Ing. D.E.O.A.	REVISADO: Ing. D.E.O.A. / Ing. F. Mejia
FECHA: F. Bueno Ch. / Diciembre 1999	
PLANO	AA-05
PROYECTO	CAD-007/99
ESCALA	1/125



CORTE A-A

EQUIPOS DE AIRE ACONDICIONADO		
CARACTERISTICAS	UMA-2	FC-2-1
TIPO	UNIDAD MANEJADORA	FAN-COIL
CANTIDAD	1	1
MARCA	McQuay	McQuay
MODELO	LSL 117	TSH 101

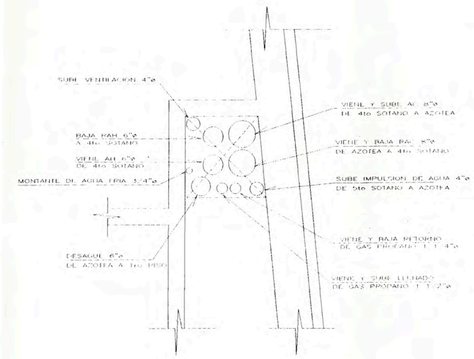
EXTRACTORES CENTRIFUGOS		
CARACTERISTICAS	EC - 01	EC - 02
CANTIDAD	1	1
MARCA	Penn	Penn
MODELO	ZC 10	ZC 10

CLAVE DE REJILLAS

① RR 12"x12"

CLAVE DE DIFUSORES

① RD=12"x12"
② DIF 10"x10"
③ DIF= 8"x 8"
④ DIF=12"x12"



DETALLE Nro 1

NOTAS :

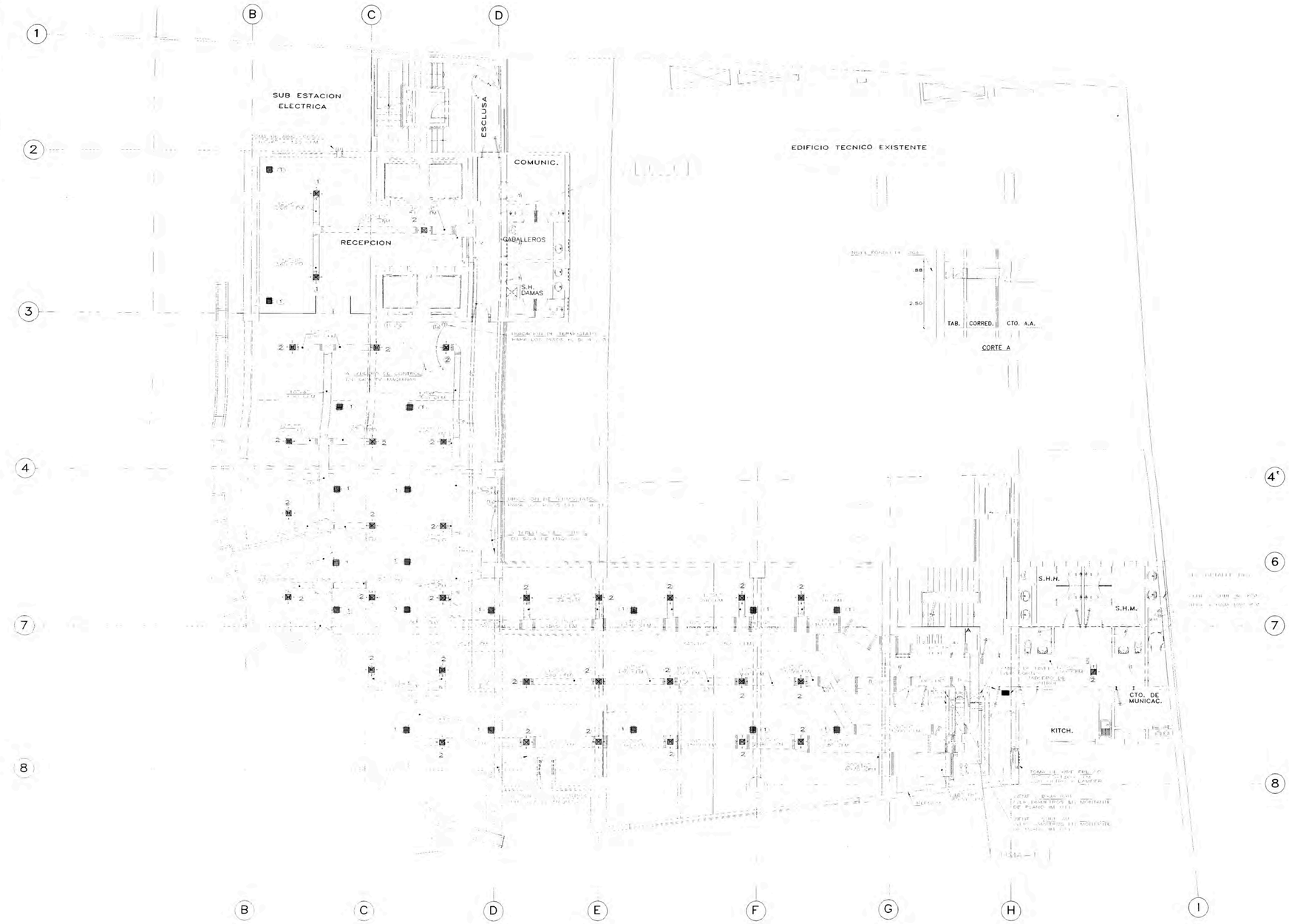
1.- VER LEYENDA, NOTAS GENERALES Y DETALLES EN PLANO IM-01

TERMO SISTEMAS s.a.

LOS EBANISTAS N°102 - URB. EL ARTESANO - ATE - VITARTE TELF. 4-359238 FAX. 4-376366

PROPIETARIO:	*TELEFONICA - GRIMALDO DEL SOLAR*	LAMINA: *AA-06*
ESPECIALIDAD:	*Sistema de Aire Acondicionado*	
PLANO:	*Planta 2° Piso*	
UBICACION:	*Calle Grimaldo del Solar N° 292 - Miraflores*	ARCHIVO: *CAD-007/99*

DISEÑO	REVISADO	APROBADO	DIBUJADO	FECHA	ESCALA
Ing. D.E.O.A.	*Ing. D.E.O.A.*	*Ing. F. Mejia*	*F. Bueno Ch.*	*Diciembre 1999*	*1/125*

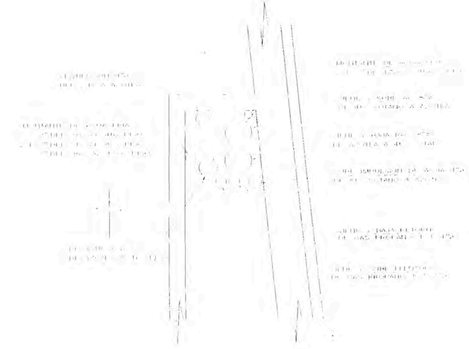


CORTE A

EQUIPOS DE AIRE ACONDICIONADO TIPICOS EL 3er AL 11vo PISO		
CARACTERISTICAS	UMA–T	FC–T
TIPO	UnidaddeManejadora	FAN–COIL
CANTIDAD	9	9
MARCA	McQuay	McQuay
MODELO	LSL 117	TSH 121

CLAVE DE REJILLAS

CLAVE DE DIFUSORES



DETALLE Nro 1

NOTAS :

1.– VER LEYENDA, NOTAS GENERALES Y DETALLES EN PLANO IM–01

TERMO SISTEMAS s.a.

LOS EBANISTAS N°102 - URB. EL ARTESANO - ATE - VITARTE TELF. 4-359238 FAX. 4-376366

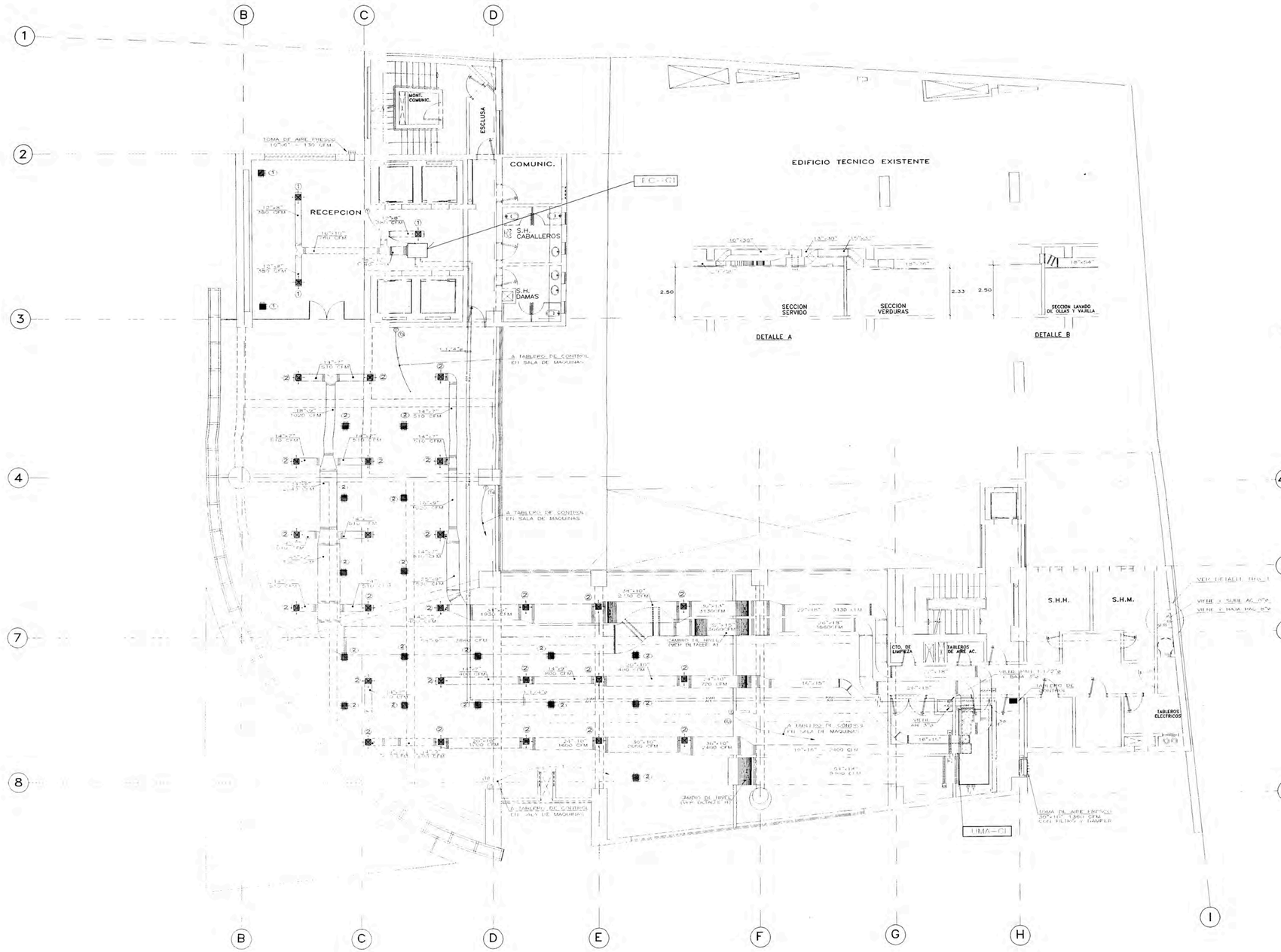
TELEFONICA - GRIMALDO DEL SOLAR

Sistema de Aire Acondicionado — AA-07

Planta 3°al 11° Piso (Tipico)

Calle Grimaldo del Solar N° 292 - Miraflores — CAD-007/99

Ing. D.E.O.A.	Ing. D.E.O.A.	Ing. F. Mejia	F. Bueno Ch.	Diciembre 1999	1/125



EQUIPOS DE AIRE ACONDICIONADO

CARACTERISTICAS	UMA-CI	FC-CI
TIPO	Manejadora de Aire	FAN-COIL
CANTIDAD	1	1
MARCA	McQuay	McQuay
MODELO	LSL-122	SHB-121

CLAVE DE DIFUSORES

① DIF= 12"x12"
② DIF= 14"x14"

CLAVE DE REJILLAS

③ RH 14"x14"
④ RH 16"x16"

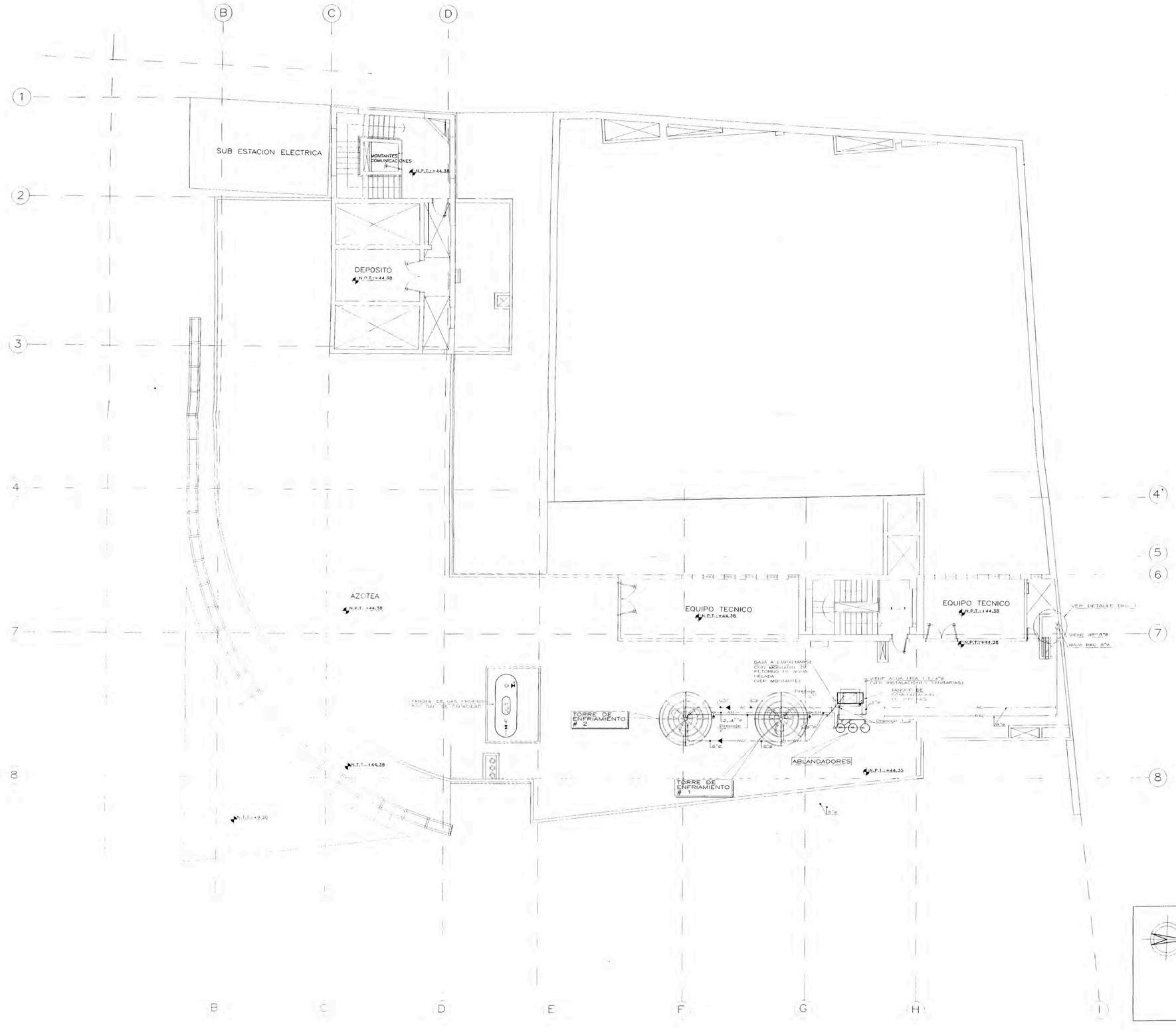
NOTAS :

1.- VER LEYENDA, NOTAS GENERALES Y DETALLES EN PLANO IM-01

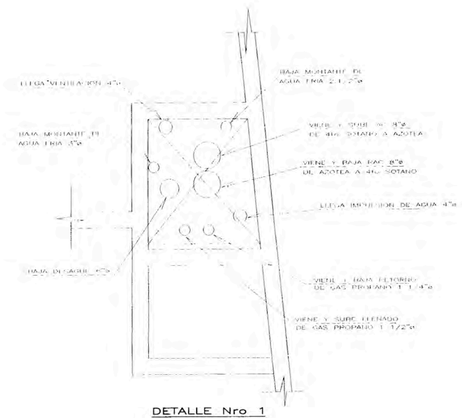
TERMO SISTEMAS s.a.
LOS EBANISTAS N°102 - URB. EL ARTESANO - ATE - VITARTE TELF. 4-359238 FAX. 4-376366

PROPIETARIO:	TELEFONICA - GRIMALDO DEL SOLAR	LAMINA: AA-08
ESPECIALIDAD:	Sistema de Aire Acondicionado	
PLANO:	Planta 12° Piso	
UBICACION:	Calle Grimaldo del Solar N° 292 - Miraflores	ARCHIVO: CAD-007/99

DISEÑO	DIBUJO	SUPERVISO	DE APROBO	FECHA	ESCALA
Ing. D.E.O.A.	Ing. D.E.O.A.	Ing. F. Mejia	F. Bueno Ch.	Diciembre 1999	1/125



TORRE DE ENFRIAMIENTO	
CANTIDAD	2
MARCA	PROTEC
MODELO	PCT-175



DETALLE Nro 1

NOTAS :

1.- VER LEYENDA, NOTAS GENERALES Y DETALLES EN PLANO IM-01

TERMO SISTEMAS s.a.

LOS EBANISTAS N°102 - URB. EL ARTESANO - ATE - VITARTE TELF. 4-359238 FAX. 4-376366

PROPIETARIO	*TELEFONICA - GRIMALDO DEL SOLAR*				LAMINA
ESPECIALIDAD	*Sistema de Aire Acondicionado*				*AA-09*
PLANO	*Planta Azotea*				
UBICACION	*Calle Grimaldo del Solar N° 292 - Miraflores*				PROYECTO *CAD-007/99*
DISEÑO *Ing. D.E.O.A.*	REVISADO *Ing. D.E.O.A.*	APROBADO *Ing. F. Mejia*	DIBUJANTE *F. Bueno Ch.*	FECHA *Diciembre 1999*	ESCALA *1/125*